THE FUTURE OF TELECOM CABLE REPAIRS IN AND AROUND OFFSHORE WIND FARMS

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Abstract: The paper will look at the increasingly complex matter of telecom cable repairs in and around offshore wind farms; this is very much a live issue in Europe and UK waters, but has an increasing global focus as many countries look to reduce their carbon footprint e.g. China, Taiwan, USA etc. The submarine telecoms cable industry needs to be aware of this and prepare accordingly.
The paper will describe the causes of these challenges, the impacts of these developments to existing maintenance arrangements, offer a view on the position of these developments under UNCLOS and propose potential solutions that may be implemented.
The paper will address the increased station keeping and associated cost requirements compared to those of traditional cable ships and will explore the impact on planning and the many operational, commercial and safety issues associated with operating a cable repair vessel in a constrained spatial environment. It will also re-enforce the importance of capturing these in proximity and crossing agreements prior to agreeing to any impacting marine construction. Additionally, the paper will look at the need to maintain connectivity paths between national and international land masses, so as to maintain functional e-economy's as well as drawing out the potential future impact that telecom cable repairs will have on a wind farm power cable connectivity and maintenance.

1. INTRODUCTION

This paper aims to primarily explore the many issues associated with placing fixed wind farm structures around existing submarine fibre optic cables and other deployed sea bed infrastructure e.g. power cables and oil & gas pipelines, although it should be noted that the latter has increased safety and regulatory criteria due to the combustible nature of the hydrocarbon products involved, and potential pollution implications associated with such products. Figure 1 is an example of the complexity of sharing the seabed.

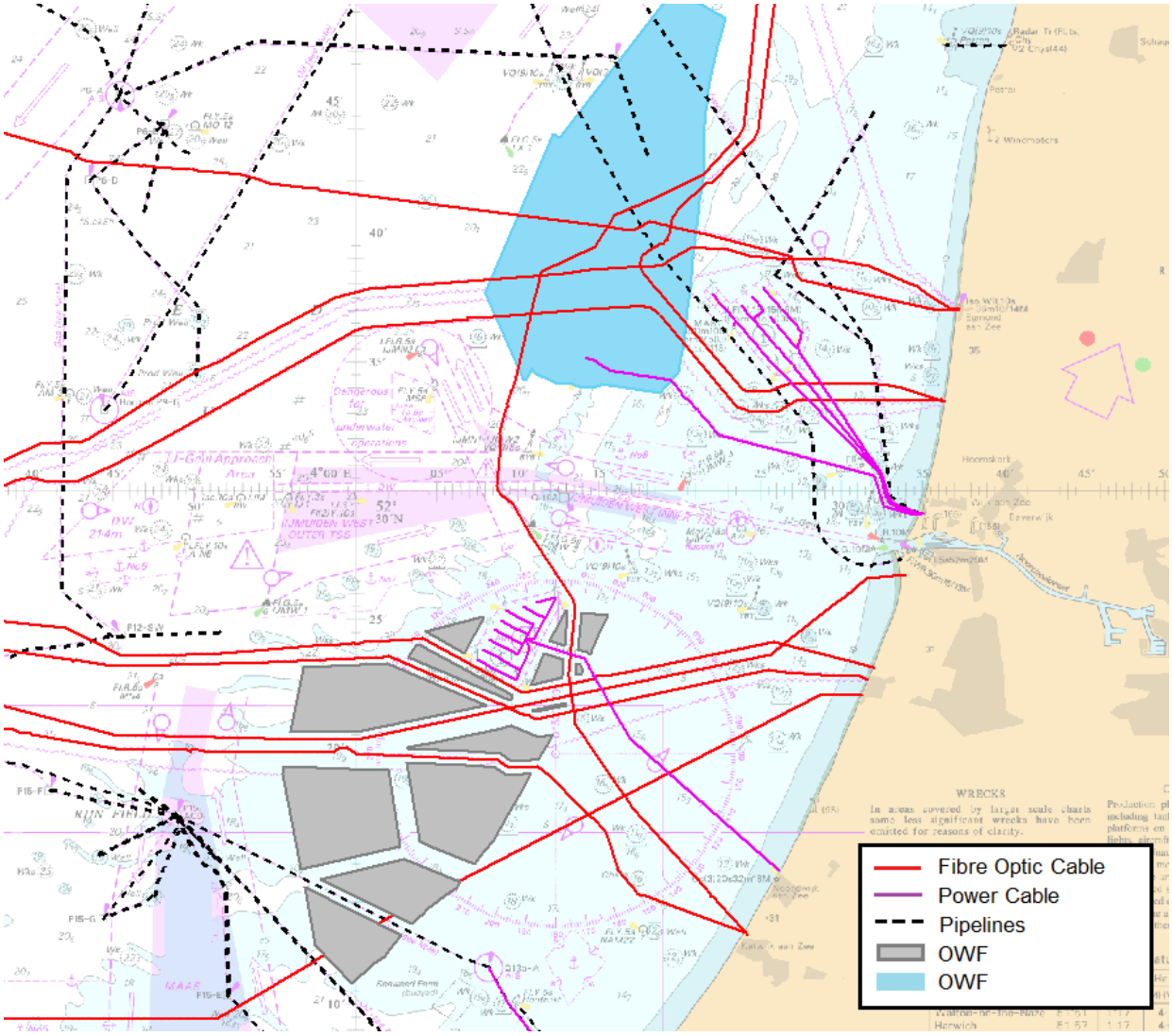

Figure 1: Planned and proposed Belgium and Dutch wind farm infrastructure and its interactions

As a starting point, it is worth revisiting and reminding ourselves of the freedoms submarine cables and pipelines presently enjoy under the existing United Nations Convention on the Law of the Sea (UNCLOS) regime (please see below) which has been adopted by many governments worldwide:

UNCLOS (1982) [2]
Article 51, Existing agreements, traditional fishing rights and existing submarine cables

2. An archipelagic State shall respect existing submarine cables laid by other States and passing through its waters without making a landfall. An archipelagic State shall permit the maintenance and replacement of such cables upon receiving due notice of their location and the intention to repair or replace them.

Article 58 Rights and duties of other States in the exclusive economic zone.

1. In the exclusive economic zone, all States, whether coastal or land-locked, enjoy, subject to the relevant provisions of this Convention, the freedoms referred to in article 87 of navigation and overflight and of

the laying of submarine cables and pipelines, and other internationally lawful uses of the sea related to these freedoms, such as those associated with the operation of ships, aircraft and submarine cables and pipelines, and compatible with the other provisions of this Convention

Article 79, Submarine cables and pipelines on the continental shelf:

1. All States are entitled to lay submarine cables and pipelines on the continental shelf, in accordance with the provisions of this article.

2. Subject to its right to take reasonable measures for the exploration of the continental shelf, the exploitation of its natural resources and the prevention, reduction and control of pollution from pipelines, the coastal State may not impede the laying or maintenance of such cables or pipelines.

4. Nothing in this Part affects the right of the coastal State to establish conditions for cables or pipelines entering its territory or territorial sea, or its jurisdiction over cables and pipelines constructed or used in connection with the exploration of its continental shelf or exploitation of its resources or the operations of artificial islands, installations and structures under its jurisdiction.

5. When laying submarine cables or pipelines, States shall have due regard to cables or pipelines already in position. In particular, possibilities of repairing existing cables or pipelines shall not be prejudiced.

Based on the above it could be said that coastal states planning major off shore infrastructure in whatever form it may take, be it wind farms, wave energy projects, inter-tidal generation, wave energy production, carbon capture and storage, fixed seismic arrays or deep-sea mining, should actively engage in advanced communication and pro-active stakeholder consultation with existing and prospective future seabed tenants. Failure to do so will most likely lead to project delays and legal challenges as the impacted party seeks operational and financial protection from the licensor or the lead developer.

There have already been a number of instances globally, where cable owners have been forced to take legal re-course. Examples of this include one off the UK, in the Irish Sea. There is also an example in the USA, at Admiralty Inlet in Puget Sound (Washington State), where a local utility company, Snohomish County Public Utility District, sought permission to install inter-tidal turbines in very close proximity (170m and 238m respectively) to an existing trans-Pacific submarine cable installation; following a long legal process in which the cable owner was supported by the North American Submarine Cable Association, the proposed development was halted.

2. BACKGROUND

A current example of this issue is to be found in the extensive and dense building presently occurring off the Belgium and Dutch coasts, where the governments have mandated cable corridors of +/- 250m for Belgium and +/- 500m for the Netherlands. Corridors of these widths are not in line with the applicable existing industry guidelines (European Subsea Cable Association's (ESCA) guideline No.6 and International Cable Protection Committee (ICPC) Recommendation No.13) and do not allow the existing contracted subsea repair assets to safely access the designated cable corridor. Whereas following the prescribed industry minimum corridor distance of +/- 750m either side of a submarine fibre optic cable (Figure 2 below) would have safely done so. The access restrictions, along with agreement with respect to suitable proximity

processes and procedures are explored in more detail below.

In the view of the authors of this paper that the mandated cable corridors are not in line with UNCLOS.

It is important to stress that the development of the above industry guidelines were a direct result of intensive dialogue by both the telecommunications and renewables industries in the UK. This was a formidable task reflecting the differing industry views; at the time there was limited experience in the offshore renewables sector and a lack of primary research data on potential new interactions. This required the commissioning of an evidentiary desk top study, led by the UK's Crown Estate [4]. It took nearly two years to reach a workable consensus and publish the resulting guideline. Following publication, of ESCA guideline No.6 and the subsequent ICPC recommendation No.13, both were shared with other cable associations to highlight the risks and offer a script on how best to approach such interactions, wherever they may occur.

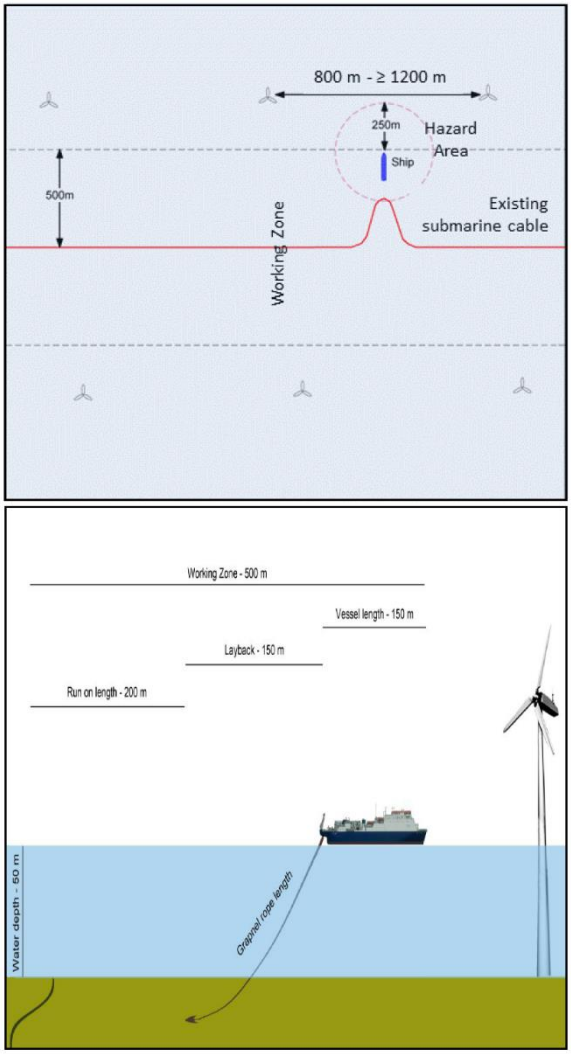

Figure 2: Safe operating distances - Extract ESCA Guideline No.6 [2]

3. REPAIR OPTIONS AND RESTRICTIONS

The telecommunication cables that are coincident with the proposed Belgian and Dutch Offshore Wind Farms (OWF) development areas and currently enjoy open access with no or only limited fixed surface infrastructure in close proximity, which would impact the telecommunication cables maintenance activities. During and after the construction of the various Belgian and Dutch OWF developments, cable ship access will be restricted by both the surface infrastructure, due to designated protection zones and the various new crossings and OWF power cables, and potentially by new regulations that the authorities may impose.

Consequently, subsea telecommunication cable repair work will become more complicated, and therefore costlier due to the presence of the new OWF infrastructure. This new infrastructure will certainly impact how the existing cables are repaired, these are traditionally approached as SPOT repairs, as per the description below:

- SPOT repairs, refers to the standard telecommunication cable repair technique that is routinely undertaken in open water where the repair is limited to the extent of the damaged cable only, plus some small additional length to accommodate for water depth. (Typically, 500m or so in the water depths documented as part of this paper)

As previously highlighted, the requirements of different coastal states (the Netherlands and Belgium) vary. Within the Belgium zone, the Belgian OWF's incorporate cable maintenance corridors intended to allow access to the in-service cables, which are 250m either side of the existing cable, 500m wide in total. In the Dutch zone, legislators also incorporated cable maintenance corridors to allow access to the in-service cables. These extend some 500m either side of the cable, 1km wide in total. Both fail to meet the minimum distance (750m) expressed within the existing industry guidelines.

If a SPOT repair is not possible, then it may be necessary to consider a Cable Recovery And Lay Through repair (CRALT) repair.

- CRALT, refers to the repair technique which has historically been proposed as a 'compromise' solution between cable owners and wind farm developers, when there is close proximity between incumbent telecommunication cables and the new surface infrastructure (wind turbines generators, substations etc.). For the CRALT repair, a new extended cable section may be inserted. The length of the extended cable section is determined by the distance over which the proximity impact extends (e.g. length the incumbents telecommunication cable is proximate to new surface infrastructure including up to the boundaries of the wind farm plus a safety margin), plus a short additional length to accommodate the water depth. The new length of replaced cable can be significant, depending on the complexities of the individual circumstances, and may extend to 25 plus kilometers

In addition to being a much more resource expensive form of repair, a CRALT presents both cable owners and cable ship operators with additional challenges, particularly where the currently contracted cable ships are not able to operate safely. This is the case with Belgium's designated corridors and to a slightly lesser extent the Dutch corridors, these issues and restrictions are listed below:

Generic Belgium Operating Environment (+/-250m Maintenance Corridor):

- The currently contracted cable ships will not be able to enter any Belgium Offshore Wind Farm Zones until they, or the cable owners, have received written permission from either the Regulatory Authorities and/or the wind farm and other asset owners. Additionally, acceptable written Procedural, Liability and Indemnity provision needs to be in place both ways, as usually secured through formal Crossing and/or Proximity Agreements with the cable and third party asset owners, including where applicable the relevant parties insurers

- Safe spot repairs will not be possible within the Belgium corridors using currently contracted cable ships
- Safe recovery and lay through type repairs will not be possible within the Belgium corridors using currently contracted cable ships

Generic Dutch Operating Environment (+/- 500m Maintenance Corridor)

- The currently contracted cable ships will not be able to enter any Dutch offshore wind farm zones until they, or the cable owners have received written permission from either the Regulatory Authorities and/or the wind farm and other asset owners, and with acceptable written Procedural, Liability and Indemnity provision in place both ways, as usually secured through formal Crossing and/or Proximity Agreements with the cable and third party asset owners, including where applicable the relevant parties insurers
- Safe spot repairs will not be possible within the Dutch corridors using currently contracted cable ships
- Safe recovery and lay through type repairs may be possible within the Dutch corridors using a currently contracted cable ship, subject to site specific revisions to operating procedures and environmental conditions, including a tug in attendance, and that the Post Repair Inspection Burial (PRIB) and other reinstatements will be completed separately by a cable ship, with capabilities greater than those currently contracted; with a Guard vessel potentially left on site in the interim, and that the risks, impacts and mitigations have been formally assessed and accepted by all the relevant parties

As highlighted, narrow corridors in addition to restricting the type of vessel commonly used for submarine cable repairs i.e. Dynamic Positioning 1 (DP1) along with much greater weather restrictions, means a requirement for either a more capable and expensive cable ships (i.e. DP2) or additional resources to undertake a CRALT repair. The other major issue to consider is the use of safety zones around OWF infrastructure, especially during the construction phase, where it would impinge on the designated corridors and make traditional repairs even more untenable. To cover all the envisaged hazards and issues during construction and operation of an OWF, a detailed proximity agreement needs to be executed, including the preparation and mutual approval of appropriate operational processes. It should be stressed that these processes and procedures are required between all the relevant asset owners (telecom cable, power cable, pipeline, wind farm) and where necessary the relevant authorities. Such a comprehensive approach is recommended in order to satisfy relative operational, commercial, regulatory and QHSE (Quality, Health & Safety and Environment) responsibilities of each of the various parties.

NB: The particular terms of these Crossing and/or Proximity Agreements are generally a private Agreement between the asset owners, this can vary on a case by case basis to suit the specific circumstances of the development and parties involved.

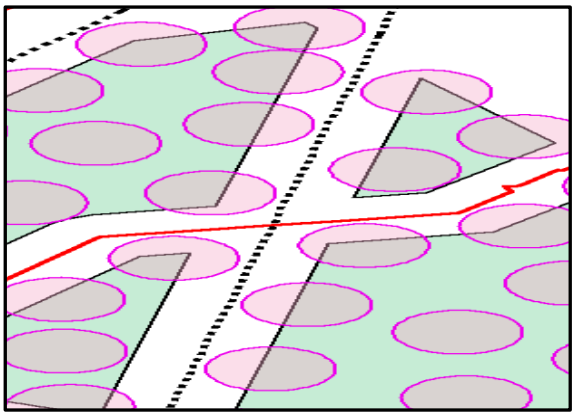

Figure 3 Example showing 500m's safety zones (Pink) around proposed infrastructure and the impact on access corridors

It should also be reiterated, that a reasonable and balanced approach to offshore proximity discussions is recommended. Many of the factors discussed, theoretically become superfluous at sea when the overriding safety concerns of any cable ship captain must prevail. The master of any vessel at sea is fully accountable for the safety of his/her vessel and crew working in the environmental and weather conditions of the day. These conditions are outside of either the licensing authority, cable owners' or renewable developers' control. Both ESCA and ICPC state that, "The master or captain will always retain the prerogative to depart from guidelines (or recommendations)" as it is the captain who is responsible for the safe navigation of the vessel and for the safety of those on board.

Figure 4 below shows the comparison in costs and time associated with the different repair solutions.

	CRALT(DP1)	Hrs	Spot Repair (DP2)	Hrs	Standard Spot Repair (DP1)	Hrs
Estimated Repair Costs	DP1 X 12	Base hrs x 12	DP1 X 1.5	Base hrs x 1.5	$500K	250

Figure 4 above is for average annual weather. All figures are $ USD.

Existing and Future Operational Constraints Associated with OWF's:

- In a number of geographical areas, the increasing development of the seabed has already impacted the ability of contracted cable repair vessels to sail within the established industry time lines and to complete a repair without formalised third party engagement/agreement between the submarine cable owner and the owner of the other subsea asset

- The number of complex and pre-planned interactions will become more common as the level of Continental shelf/Exclusive Economic Zone **(**EEZ) development increases. This will increase the operational burden on all parties, but in particular the asset owners who will need to ensure there is an agreed proximity/repair framework in place prior to any repairs commencing, and in order to prevent undue delays

- In certain geographical locations there are different levels of vessel specification required for repairing telecommunication cables and renewable infrastructure. All stakeholders should be aware that such differences do exist and may need addressing in the future

- There is a greater lease premium attributable to higher dynamic positioning specification vessels. Depending on the type and level of development undertaken, established industry vessel specifications may need to be upgraded with a corresponding cost increase

- The operational distances agreed in ESCA guideline No.6 and ICPC Recommendation No.13, are subject for safety reasons to master's discretion along with any undefined operational interactions

4. ASSOCIATED RISK ANALYSIS AND EVALUATION

As part of this paper, it was necessary to consider the sources of risk for the envisaged tasks, investigate ways to mitigate these risks, and examine how the risks may change. It was also necessary to consider ways to mitigate the cost to both parties. The mitigation measures can be summarised as follows:

1. Early stakeholder communication.
2. Optimising OWF infrastructure design to better meet multiple stakeholder requirements
3. Early agreement on enhanced processes and procedures
4. Selection of appropriate vessel capability
5. Plant pooling
6. Restrictions on marine activities within OWF
7. Ongoing marine liaison and monitoring

5. FUTURECONSIDERATION POINTS AND RISKS

In addition to creating a much more complex operational environment, the citing of OWF infrastructure in a (parallel) barrier fashion along a nation's coastline; can in addition to creating the need to upgrade existing telecom repair vessel assets also lead to a reduction in cable route options, or no feasible route access for future submarine cables in close proximity to multiple OWF developments. Given the strategic importance of submarine cables to any modern economy and the need for route diversity in particular from the newer content entrants (e.g. Google Facebook, Microsoft, etc.), as well as the established telecom players (e.g. AT&T, BT, DT, Eir, Orange, Vodafone, VzB etc.), who require diversity for their enterprise customers (e.g. banking, close of business settlement, air traffic control, emergency services communications and private company intranet services). Reducing feasible marine route options will almost certainly impact e-economy activities, whether this be a delay to repairs, or a significant reduction in deployed infrastructure.

Governments should also consider the cost and employment impact on specific financial service segments, in particular trading, which as far as practicable requires the shortest possible route between two financial hubs so as to reduce transmission loses to their lowest possible denominator (at the time of construction). Impeding such routing, could have a major economic impact on the trading services sector, but also any linked financial activities.

Another key point for consideration is the increased risk and costs associated with constricting fibre optic submarine cables in narrow cable corridors, or in some cases de-facto corridors, created simply by the absence of OWFs. Of particular concern is the increased risk profile of a major cable impact event, whether it be an anchor drag, vessel sinking, illegal trawling or given today's heightened geopolitical environment, sabotage.

A fourth point, worthy of consideration by national and/or regional regulators is the increased operational and maintenance costs for wind farm operators. Any telecoms repair within a corridor that contains OWF inter-array link cables or export cables could lead to multiple crossings of the power cables as part of a telecom cable repair, or any future deployment of hydrocarbon infrastructure. These will in turn make any future power cable repairs more complex and hence costly, also driving the need for drafting and maintaining detailed processes and procedures, covering the engineering approach required by the infrastructure operator and its applicable ship supplier, all

of which equates to increased O&M costs and resources.

As mentioned earlier, in relation to the joint approach undertaken with the UK renewables sector and the Crown Estate at the start of OWF development in the UK; the majority of telecom operators (where ever they are based) are keen to engage with and educate national regulators and renewable developers, to ensure that conflict resulting from poorly informed legislation is avoided. The best way to do so is to engage in an early and proactive Stakeholder analysis (the good neighbour approach), and to ensure all parties are appraised of the existing and ongoing maritime legal framework.

6. CONCLUSIONS

The increased use of the seabed is posing a significant challenge to match the differing requirements of the industries involved and to overcome these challenges takes time and money on all sides. To minimise this, early stakeholder consultation is the best way to foster the good neighbour approach.

In addition to avoid unnecessary legal delays, national legislators should consult with, and consider the needs of existing marine seabed stakeholders.

All stakeholders need to recognise the freedom to operate and maintain submarine cables and pipelines as defined under UNCLOS.

Governments should consult with national Telco and Content providers over strategic access for future submarine cable paths.

The existing industry guidelines (ESCA and ICPC) which have been developed through a robust process of hands-on and field experience should be understood and used by all stakeholders engaged with or planning these types of activities.

Finally, all marine stakeholders need to ensure they communicate effectively with their peers through ongoing dialogue, and document all of their mutual operational requirements to ensure that there are no unnecessary delays to operations and maintenance activities, should they be required.

7. REFERENCES

[1] UNCLOS Articles 51, 2 and 79, 2 - 1982
[2] ESCA Guideline No 6 – Issue 5 2016
[3] ICPC Recommendation No 13 – Issue 2A 26th Nov. 2013
[4] Crown Estate - The Proximity of Offshore Renewable Energy Installations & Submarine Cable Infrastructure in UK Waters
[5] SUBOPTIC 2013 from Ocean to Cloud
[6] NASCA. Re:Admiralty Inlet Pilot Tidal Energy Project, Federal Energy Regulatory Commission (FERC), Project No 12690-0005 (“Project”) 13th February 2013

