NEW METHODOLOGIES FOR DESK TOP STUDY CABLE ROUTE PLANNING

Andy Palmer-Felgate, (Verizon)

andy.palmer-felgate@uk.verizonbusiness.com

Verizon, Reading International Business Park, Basingstoke Rd, Reading, Berkshire RG2 6DA, UK

Abstract
The objective of a desk top study (DTS) is to identify the safest and most technically viable route for the engineering, construction, installation and subsequent maintenance of a submarine cable system. The International Cable Protection Committee Recommendation 9 recognises that failure to complete a thorough DTS will inevitably result in increased survey and marine installation costs and impact the scheduled Ready for Service (RFS) date of the system. More significantly from an owner's perspective it could have a dramatic impact on the reliability and maintenance costs over the life of the system.

This paper describes how vessel tracking systems such as Automatic Identification System (AIS) can be utilised in a DTS to identify environments where there is a high risk of external aggression faults. AIS data has been collated over an eight month period to identify extensive anchorages (up to 15km radius) which were previously uncharted and unknown to compliers of desk top studies.

1. INTRODUCTION

AIS is a short range coastal tracking system used on ships and by Vessel Traffic Services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships and VTS stations. Information such as unique identification, position, course, and speed can be displayed on screen. AIS is intended to assist the vessel's watchstanding officers and allow maritime authorities to track and monitor vessel movements, and integrates a standardized VHF transceiver system such as a Global Positioning System receiver, with other electronic navigation sensors, such as a gyrocompass or rate of turn indicator.[1]

The International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea (SOLAS) requires AIS to be fitted aboard international voyaging ships with gross tonnage (GT) of 300 or more tons, and all passenger ships regardless of size. It is estimated that more than 40,000 ships currently carry AIS class A equipment. [1]

AIS data is available worldwide from providers of subscription services, or at a lower sampling rate for free via the internet. The coverage of the data is limited by the range of the AIS transponders at ports collecting and distributing the signals, which is typically about 74 kilometres.[1]

The aim of this research has been to analyse AIS data over a long time period to identify where submarine cable routes are at high risk of external aggression damage from anchored vessels, and where routes exist which minimise such risks.

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Experience from cable owners utilising AIS for identifying vessels responsible for cable faults is showing that many faults previously attributed to fishing have in fact been caused by anchoring, or accidental deployment of ships' anchors.

2. METHODOLOGY

Worldwide AIS data was downloaded from a freely available source on www.vesseltracker.com at regular intervals from July 2009 to February 2010. Over one millions vessel positions were collated during this period and merged into a single text file. Each position has attribute information associated with it detailing the name of the vessel and status (anchorage, waiting at anchor, moored, moving[heading]). Data for moored or moving vessels was eliminated, resulting in a filtered dataset of 292,167 points.

The points were plotted in a Geographical Information System along with coastlines, maritime boundaries and in-service telecoms cables from the current Global Marine Cables Database. Admiralty Raster Charts were used to identify whether vessels were anchored within charted anchorages.

Three specific areas were identified as being of interest due to extensive clusters of anchored vessels close to in-service submarine cables. In all cases these cables were known to have suffered multiple faults. The three areas were:

- The Southern North Sea
- The Persian Gulf
- Approaches to Hong Kong

From the vessel names, it was possible to identify the predominant vessel type frequenting a particular anchorage, and therefore gain an understanding of the size of the anchors being deployed.

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3. RESULTS

Area 1: The Southern North Sea.

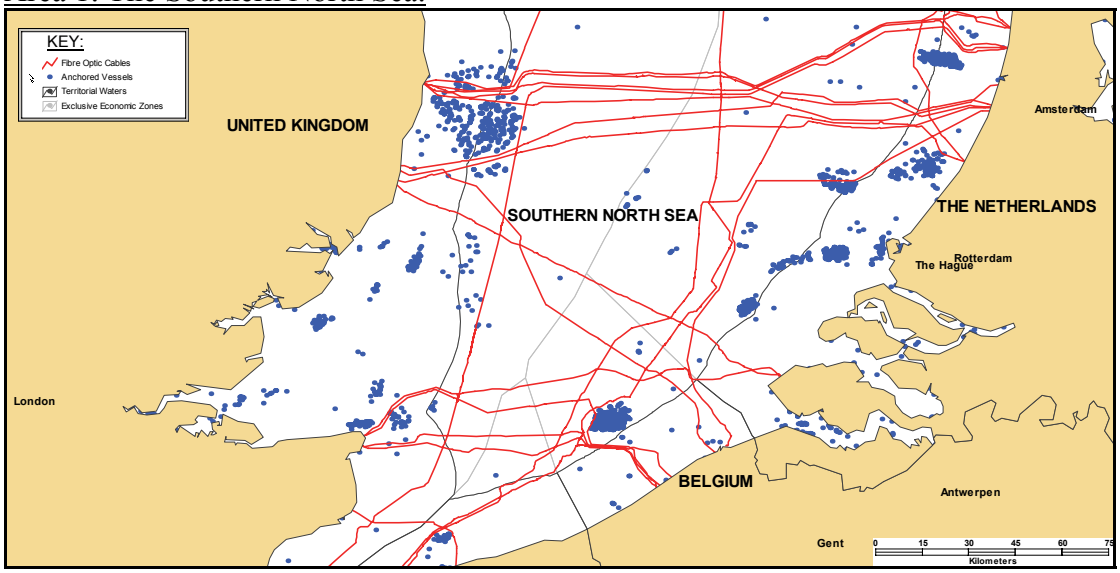

Figure 1: Vessels anchoring positions off the east coast of England, the coast of The Netherlands and the coast of Belgium in the Southern North Sea.

Fifteen isolated clusters of anchored vessels can be identified from figure 1, the most extensive being off the east coast of the UK. This area of anchoring is approximately 30km in diameter and is adjacent to eight submarine cable systems. It has been suggested that the recession and high oil prices have prompted a lull in work for oil tankers, meaning that they need to anchor offshore to wait for instructions from their operators when more work comes in[2]. Although the cables are charted, demand for space to anchor, or lack of vigilance, has resulted in multiple cable faults in the vicinity.

Of the other fourteen clusters on figure 1, eleven are charted anchorages. Several of the anchoring areas northwest of Rotterdam have expanded beyond their charted limits however, and pose a risk to submarine cables nearby.

For a new submarine cable system in the Southern North Sea, the data presented in figure 1 would enable the planner to engineer a safe route away from the official and unofficial limits of anchoring.

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Area 2: The South East Persian Gulf

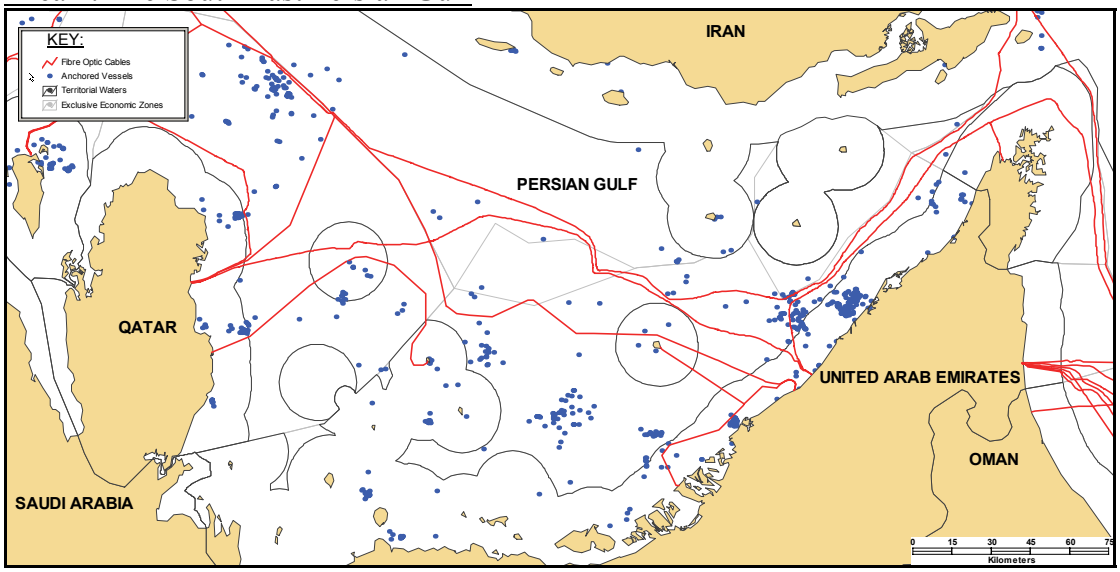

Figure 2: Vessel anchoring positions in the South East Persian Gulf

Anchoring off the coasts of Qatar and the United Arab Emirates (UAE) is widespread due to the shallow water depths and various marine operations being carried out such as oil and gas extraction and aggregate dredging. Anchoring off the ports of Dubai and Abu Dhabi in UAE is prevalent over two in-service cables north and west of a charted anchorage.

Some of the reported anchoring positions are in fact dredgers which operate over large areas of the gulf supplying aggregates for land reclamation projects. These have been responsible for multiple cable faults, but as can be seen on figure 2, there are routes available to new systems which avoid high risk areas by considerable margin. Anchoring northeast of Qatar is less isolated, but in most cases can be attributed to oil and gas support vessels operating near the main fields.

Area 3: Approaches to Hong Kong

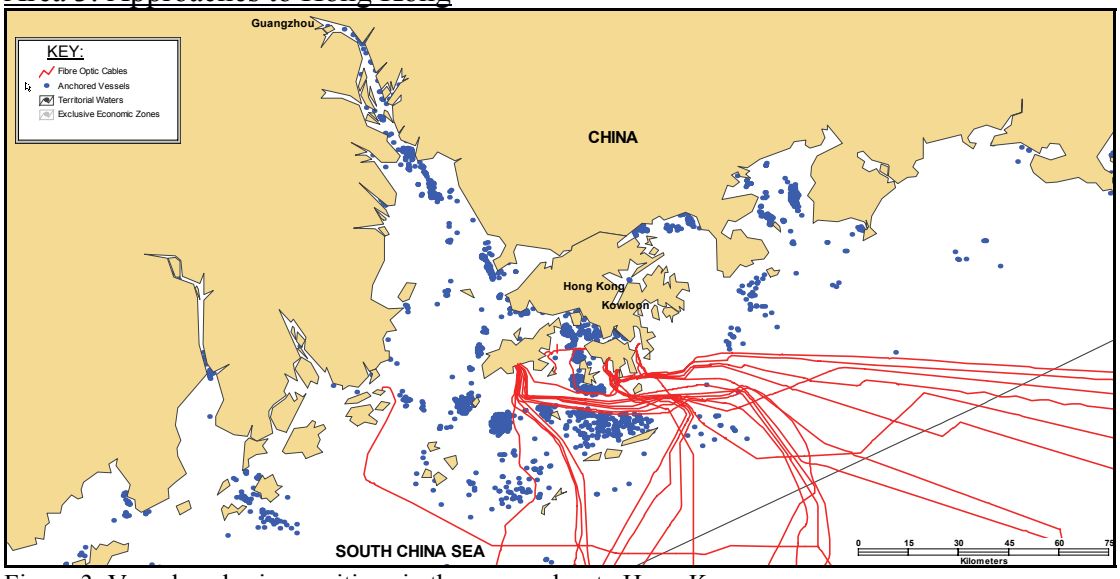

Figure 3: Vessel anchoring positions in the approaches to Hong Kong

The waters off of Hong Kong are carefully regulated by the Port Authority, however as can be seen from figure 3, there are approximately 6 submarine cables which are impacted by 'overspill' from the designated anchorages. The data shows these congested waterways are subject to extremely high density anchoring, and the demand for sheltered waters often leads to the limits of the charted anchorages being tested.

The majority of vessels identified via AIS off Hong Kong are large cargo ships which when anchoring pose a significant risk to the deepest of buried cables. The region is put under particular pressure during a Typhoon, when many vessels are seeking shelter behind the many small islands.

Figure 3 describes graphically why the cable fault records between the two dozen cable systems landing in Hong Kong is so varied, and also enables one or two safe routes for new cables to be engineered with confidence, often utilising the safety of the shipping lanes and Traffic Separation Schemes.

4. CONCLUSION

The examples in this paper illustrate on a case by case basis how AIS data can be used to visualise the actual activities being untaken in the marine environment rather than relying on hypothetical information from a chart or pilot book. AIS data collected over the long term provides useful information for owners and route planners alike, and has the potential to save millions of dollars in future repair costs for cable systems undertaking a desk top study.

As a further development, data collection over longer timescales and larger areas would enhance the quality of this research. To that end, in November 2009, the STS-129 space shuttle mission attached an AIS VHF antenna to the Columbus module of the International Space Station[1]. This has the potential to create global AIS coverage, which would be of significant benefit to the submarine cable industry.

5. REFERENECES

[1] 'Automatic Identification System'
http://en.wikipedia.org/wiki/Automatic_Identification_System

[2] 'More ships anchor off Suffolk coast'
http://www.edp24.co.uk/content/edp24/news/story.aspx?brand=EDPOnline&category=News&tBrand=EDPOnline&tCategory=xDefault&itemid=NOED13%20Aug%202009%2020%3A24%3A46%3A967

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