THE PUSH FOR POLAR PROJECTS:

CHALLENGES AND REMEDIES IMPACTING THE DESIGN AND IMPLEMENTATION OF ARCTIC SUBMARINE CABLE SYSTEMS

Hector Hernandez, Wayne Nielsen (WFN Strategies)
hhernandez@wfnstrategies.com

WFN Strategies, 21495 Ridgetop Circle, Suite 201, Sterling, Virginia 20166 USA

Abstract: The advent of Polar submarine cable systems is barely upon us, with new regional and international designs being considered and implemented in the near future. The business driver for implementing a Polar System is that of speed and route diversity, as well as sovereign desires to connect Indigenous communities, and support mineral extraction enterprises. The push to design, install, and maintain Submarine Cable Systems in Arctic and remote regions of the world comes with unique challenges that need to be addressed as an Industry. Challenging Suppliers and Operators to develop real-time remedies that can support the design, implementation, and maintenance of such systems. The number of Polar systems implemented are few, as yet. However, the unique issues addressed, and ensuing lessons learned from these systems will impact and potentially drive future systems in this distinctive environment.

Drawing upon recent and exclusive experience on multiple Arctic and Antarctic projects, this paper will discuss the challenges faced and remedies developed in the design and implementation of recent Polar systems. It will consider the exceptional issues of weather, logistics, ice threats, environment, and other geographic complications impacting Polar system design, installation, and ensuing maintenance activities.

1. INTRODUCTION

As of 2005, submarine cables link all the world's continents except Antarctica, which remains the only continent yet to be reached by submarine telecoms cable. (New World Encyclopedia, 2008) In 2017, the Arctic received its first significant submarine cable system. Future such systems, both regional and transoceanic, are in the planning stages. The goal of a northwest or northeast Arctic passage seems within reach.

According to SubTel Forum's Submarine Telecoms Industry Report:

> *The first true Arctic submarine fiber system in industry history was installed in 2017. Previous systems, such as Svalbard, had only ever brushed the Arctic region. At 1,200 kilometers over 6 landing points, Quintillion Subsea Phase 1 marked the first successful and fully Arctic submarine fiber system in the world. (Clark, 2018/2019)*

From 2014 to present, nearly 7 percent of submarine cable project investment was in Arctic systems. For the period 2019-2021, more than $1 billion has been proposed to be invested in Arctic systems.

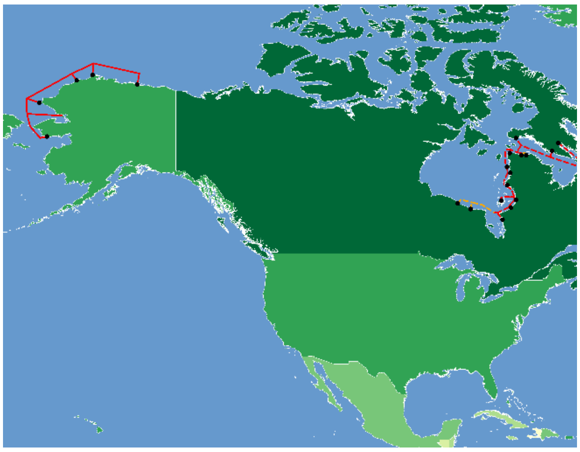

Figure 1: Current/Planned North American Arctic Systems

Planned Polar systems include EAUFON (1,800 km repeatered submarine fiber optic network connecting the Kativik Arctic of Chisasibi and Salluit), Katittuq Nunavut (2,400 km repeatered submarine fiber optic network connecting the Nunavut Arctic of Cape Dorset, Kimmirut and Iqaluit, Canada with Nuuk, Greenland) and Arctic Connect (10,500 km repeatered submarine fiber optic network connecting Finland, Russia, and Japan). These systems are focused on routes in the far north of Canada, linking up local communities or bridging the gap between Europe and Asia. Arctic Connect is an attempt to link Europe to Japan by going over top of Russia. In 2011, National Science Foundation tasked WFN Strategies to investigate a submarine fiber optic cable system to connect the continent of Antarctica to New Zealand, which has not yet been implemented.

2. BUSINESS DRIVERS TO GO OVER THE TOP

2.1 REDUCED LATENCY

One of the main drivers for Polar systems connecting Europe to Asia is to dramatically reduce data transmission latency by reducing system length. Currently, data must either go through the United States, or through the Suez Canal and Indian Ocean. These routes required system lengths over 20,000 kilometers.

According to SubTel Forum's Submarine Telecoms Industry Report:

> *Interest in the Arctic has been at an all-time high the past few years, as cable developers are looking to take advantage of the dramatically shorter routes that can be achieved through the Arctic Circle. The Quintillion Subsea system has proven that a fully Arctic system can be done for future systems that look to tackle this particularly difficult region. (Clark, 2018/2019)*

Future Europe to Asia Arctic routes are planned for approximately 10,000 kilometers — potentially cutting latency in half.

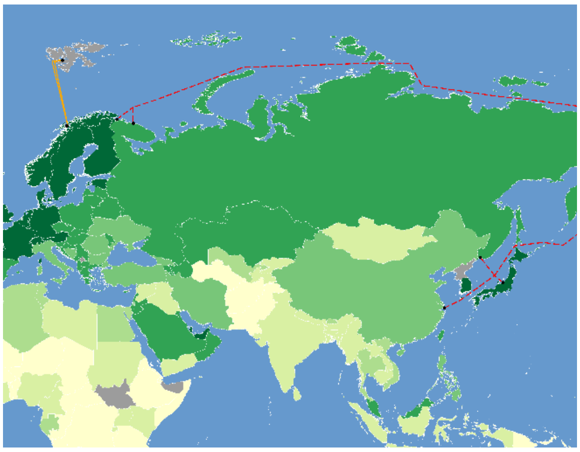

Figure 2: Current/Planned European Arctic Systems

2.2 ROUTE DIVERSITY

Creating route diversity for existing systems is also driving the push for Polar systems. Operators are looking to improve reliability and reduce risks associated with system failures by securing alternate routes for their data traffic. Additionally, Arctic routes help to avoid troubled regions, such as the Middle East and circumvent potential privacy concerns in the United States.

3. POLAR'S UNIQUE CHALLENGES

The first Polar system was installed in the Arctic region in 2017 and there are plans for new Polar systems. But they are the most uncertain as Operators face unique challenges associated with Ice, logistics, environmental concerns, and cultural sensitivities. Resulting in the need for greater planning and design efforts to address these challenges, ultimately driving up the cost to install and maintain systems in these harsh environments.

3.1 ICE

As one might expect, Ice poses the greatest risk to installing and maintaining a submarine cable system in arctic Regions. Ice threatens marine vessels and the system itself; marine vessels must operate during certain weather windows to avoid Icebergs; while systems must be prepared to sustain failures associated with ice scouring and ice stacking.

The risk is primarily associated with mean time to repair – how long it will take to repair a system failure in these conditions. The time it takes to repair a system failure depends on when the failure occurs and what marine vessels or assets are available at the time. Therefore, it is critical for Operators to have a solid restoration plan, diverse routing schemes, and a back-up system plan to reduce the financial risk associated with a system failure and sustain an acceptable level of service until the system failure is repaired.

3.2 LOGISTICS

Another unique challenge to installing and operating systems in Arctic regions is logistics. These regions are inhabited mostly by indigenous people living in small communities that are remote. Everything they consume must be transported in by airplane or marine vessel and stored locally until needed. Suppliers and Operators must consider the effort and cost to transport, store and house all equipment, material and personnel needed for the project considering weather operating windows, type of available transport and transport capacities.

3.3 ENVIRONMENT

Arctic environments also sustain endangered mammal species such as polar bears, whales, and various birds. In addition, there are great environmental sensitivities to preserve certain areas of these remote lands. Both impacting how Suppliers and Operators operate in the region, causing them to consider special planning and precautions to ensure neither is disturbed during the installation of the system and during the life of the system as operators work to maintain the system.

Figure 3: Polar Bear Watching Survey Activities

3.4 WEATHER

Bad weather is certainly not exclusive to the Arctic region, but weather conditions are more extreme due to the extremely low temperatures. Installation and maintenance operations are determined by weather windows. In North American north, for instance, the weather window for survey or cable installation activities is typically mid-July to early October – just 75 to 90 days. Operating outside of these windows require special marine vessels designed for operating in ice and is costlier due to interruptions of normal operations. In addition, any work not completed within the weather window will need to be rescheduled for the next weather window, which incurs additional costs due to re-mobilizing crews and equipment, but also impacts the project schedule and goals if not properly planned and executed.

3.5 CULTURAL SENSITIVITY

As previously stated, Arctic Regions are mostly inhabited by Indigenous people living in small communities that are remote. Operators must be sensitive and in tune to cultural differences, understanding the local perspective of the world, language, and subsistence hunting, which may include whales, walrus, and other mammals. The permitting process already takes this into account and will be realized as the Operator will be asked to conduct environmental impact assessments, develop preservation plans and require additional precautions like requiring whale observers on board installation vessels and ensuring operations are conducted outside of local hunting seasons and areas. The importance and cost associated with cultural sensitivity must not be underestimated and great effort must be made in order to ensure success.

4. LESSONS LEARNED

While there are few Polar systems operating today, there are lessons learned from the installation and operation of these systems. The following are some of the lessons learned in the implementation and operation of a Polar submarine cable system:

- **Mitigating Risks Associated with Ice Scouring** - An Ice Scour Analysis is proving to be a necessary first step in mitigating disaster in Polar systems. Risk assessment is the first step, which includes a specialized analysis of ice scouring and other data including environmental and geological hazards. The overall risk associated with implementing a Polar system can be bound to the maximum risk element, ice scouring. In general, risk from ice scouring to a buried cable depends on the scour frequency, scour length, scour depth, and cable length. While the parameters of scour length, depth, and cable length can be obtained, scour frequency must be estimated.

Figure 4: Ice Offshore Salluit

This means system designs and cable route designs to mitigate ice souring may greatly reduce the risk, but ultimately may not eliminate the risk entirely. Therefore, mitigation plans must also include diverse routing schemes and back-up systems to sustain acceptable service levels during a system failure due to ice scouring. It's not a question of if, but a question of when a system failure will occur due to ice scouring.

- **Logistics/Logistics/Logistics** - Logistics can be the most challenging aspect of working in arctic regions. All material, equipment, supplies, food, water, and personnel must be transported in and then out once the project is completed. Housing may be limited for large crews; storage areas may be limited or require acquisition or lease of additional land to stage and operate.

  Research must be done to understand logistical constraints and requirements. In some cases, simple AA batteries may not be available. It is important to know and understand the following;

  - What supplies are locally available and allowed for purchase?
  - What type of transportation (air, marine, land) is available for material, equipment, supplies, and personnel?

- What are the transportation limitations, things like size, weight and form?
- What are the logistical windows, most regions have a schedule when items may be transported?
- Is Customs inspection required, in some cases inspection may take long and could create delays.
- What must be transported out and are there special considerations? In some cases, waste, waste water, and trash must be hauled out of the region

- **Plan B** – Have a backup plan. Equipment issues, material/supplies shortages, and personnel issues can jeopardize the project budget and schedule if back-up plans are not in place. When working in the Beaufort I conditions companies are typically obligated to have two of everything, which means two complete systems and three of everything that goes in the water.
- **Weather** – Weather concerns might seem obvious, but it is frequently underestimated. Constant monitoring of the weather is critical to improving your odds of a successful Polar campaign. [Note: improving not guaranteeing.] The monitoring needs go far beyond the immediate project area as well. Knowing the regional weather conditions and how they may impact the project is equally as important.
- **Communications** – Communications in the Arctic are difficult at best and coverage may be spotty. Problematic ship communications can slow reporting and the decision-making chain of command. Such communication difficulties can be remedied by a clear process of authorization request and acceptance or pre written rules of engagements, e.g., pre-defined risk/decision matrix.
- **Cost** – Whatever the cost estimated, it is not enough. Provide contingency funds as there will be unforeseen changes in scope that will impact cost.

5. SUMMARY

While there are unique challenges for installing and operating a Submarine Cable System in Arctic Regions, there are solutions and recent experience proves systems can be deployed in these harsh environments. However, considerable effort must be made to carefully plan and design systems that mitigate the risk associated with ice, logistics, environmental concerns, weather, and Cultural sensitivities. History has proven there is nothing we can’t do and where there is a will there is a way.

6. REFERENCES

[1] Clark, K. (2018/2019). Submarine Telecoms Industry Report - Issue 7. Sterling: STF Analytics Division of Submarine Telecoms Forum, Inc.

[2] New World Encyclopedia. (2008).

