

## SURFACING: A DIGITAL MAPPING OF SUBMARINE SYSTEMS

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**Abstract:** There is a lack of public awareness about the importance of submarine cable systems, even despite the recent increase in the circulation of visual and geographic information about them. This lack of awareness can inhibit policy, regulation, and investment. This paper discusses an opportunity to improve the “cable literacy” of the general public, including policy-makers and regulators. “Surfacing,” a digital map of submarine cables built using web technologies, is designed in game-like format in which the user becomes the signal, traverses the network, and learns about the challenges companies face in constructing and maintaining cable systems.

### 1 INTRODUCTION

Visual and geographic information about submarine cables is increasingly available on the Internet, yet the dissemination of this information has not led to the creation of a well-informed public. As the ROGUCCI Report observes, there remains a profound lack of awareness by businesses, governments, and the public about their dependence on cable systems [1]. This lack of awareness can in turn cause problems for companies that seek to establish new cable routes or to protect existing ones. There is therefore a need to develop new forms of communication that bridge the “education gap” in understanding submarine cables.

“Surfacing” is a digital map of submarine systems that is currently being built using web technologies. The project is structured in part as an exploration and in part as a game. The user becomes the signal and traverses the network, tasked with finding their way to a specific destination. While doing so, they move between different cable environments and learn not only about the importance of the network, but about the challenges that companies face in

funding, building, maintaining, and using cable systems. By combining dynamic elements that elicit user interaction with narrative elements that draw a viewer into the story of the cable network, “Surfacing” is designed to expand the traditional audience for cable representations and to improve this audience’s “cable literacy.”

### 2 NETWORK VISIBILITY

The public perception of submarine networks is becoming more important to cable development, maintenance, and operations [2]. If cables remain invisible to politicians, policy makers, government regulators, business managers, and everyday users, then critical decisions about infrastructure – which could make networks more robust and accessible on a global scale – will continue to be uninformed. For example, if governments and other organizations understood the value of cable systems, recent projects such as Pacific Fibre, which could have improved the diversity of transpacific networking, increased New Zealand’s connectivity, as well as linked up Pacific Islands, might have had a better chance of finding funding. The invisibility of cables

has also long frustrated the industry in its attempts to gain protection and development rights from nations and state-run agencies.

As the uses of coastal and marine space intensify, companies continue to run into conflicts with fishermen and boaters, environmental advocates, and local developers. These groups also need to be made aware of cable routes and their importance to 21<sup>st</sup> century communications networks, in order to avoid further conflicts. Since many environmental problems are based on ignorance, educating citizens and governments about submarine cables can lower unintended disruptions and facilitate effective policy.

Several companies, including PIPE International, have used blogs and other online media to track the laying of a cable and their network's life [3, 4]. Creating a narrative about one's cable network can help with market exposure and can serve to inform shareholders of publically listed companies. Numerous industry websites publish at least some information online. The International Cable Protection Committee has done much to expand the visibility of cable systems and to make extensive information available about the historical, legal, and environmental aspects of cable networks [5].

The wealth of available data has not yet led to the creation of an informed public. This suggests that additional modes of communication must be developed. Moreover, the spread of this information reveals that in today's media environment, it is no longer effective to simply suppress information ("security through obscurity") [1]. Instead, companies must actively construct new media that communicate the importance of submarine cables, help to protect critical infrastructure, and stimulate project development. In short, they must

combat the perils of visibility with new forms of visibility.

### 3 PROJECT DESIGN

"Surfacing" is a digital mapping project that aims to convey the significance of cable systems to a broad audience beyond the cable industry. The project combines the exploration of digital stories with a game-like structure, two forms that have been underutilized in communication about submarine systems. The premise of the project is that users begin at a single point in the cable network, from which they are able to dive into a set of stories (past and present) about cable systems. From this location, they are challenged to navigate their way to a specific end point in the cable network.

The project is broken down into a series of layers:

- Image Layer
- Story Layer
- Theme Layer
- Map Layer
- Node Layer

#### 3.1 Image Layer

After a short introductory screen, the user begins their experience in IMAGE LAYER, where they see a detailed image of a single location in the cable network. High-resolution images of cable laying and operations will help to generate additional user interest. Figure 1 depicts an image from the cable station at Bamfield, Canada, which was established in the early 1900s.

The user will also be given a destination: they might be challenged, for example, to move from Bamfield across the ocean to Ninomiya, Japan.

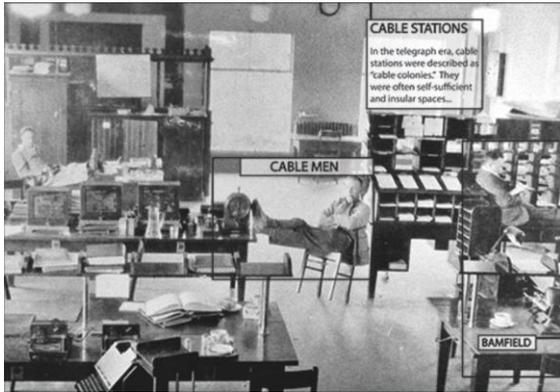


Figure 1: Image Layer

In Image Layer, the user can read the beginnings of several stories which annotate different parts of the image. In the above example, one of the stories focuses on cable stations, and describes their critical role as a hub for network activity in the telegraph era. If a user clicks on one of these stories, they move into STORY LAYER.

### 3.2 Story Layer

In STORY LAYER, the user can read an illustrated story that connects one or more places in the cable network. In the cable industry's long history, there have been many interesting narratives connecting past with present. These range from stories about cable companies' conflicts with fishermen, which might educate users about the effects of local politics, to the impact of cable networks on the circulation of local information.



Figure 2: Story Layer

Information on the Internet about cable systems is comprised primarily of technical facts. This can often be confusing to a viewer who is unfamiliar with technical systems. “Surfacing”’s textured personal narratives will connect the world of the cable system to the user’s world. Users will learn about the challenges companies face in constructing cable systems as well as the process of maintaining them. They will also illustrate companies’ tendencies to rely on tried and true historical routes.

In the example given above, the user might learn about how the cable station at Bamfield was once a hub of social life in the area, a place where locals and cablemen from around the world interconnected. The user might also learn about how cable stations were often elaborate structures and have now been repurposed for contemporary telecommunications. The cable station at Fiji, for example, has been renovated to house FINTEL, Fiji’s international telecommunications carrier.

Clicking on any of these images will lead the user back into IMAGE LAYER.

Below the stories, there will be colored threads that weave through the images. Each of these is a THEME. As shown in Figure 2, a theme might be a company such as Cable & Wireless. A theme might refer to a broader historical transition or incident that affects many sites, such as the development of fiber-optic technology. Clicking on this theme zooms the view zooms out into THEME LAYER.

### 3.3 Theme Layer

Clicking on “Cable & Wireless” would bring the user into the theme layer and would display the many points in that company’s network (Figure 3). Each of these would be illustrated with an image,

and positioned roughly over a geographic location.

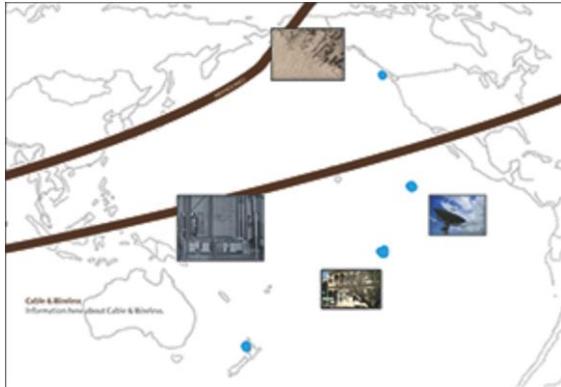


Figure 3: Theme Layer

Some individual images will be associated with multiple companies and historical transitions, and as such, these other themes will be signified a second or third set of lines through the images. If the user clicks on a second theme, then all of the images associated with that theme will appear.

Clicking back on any single image will bring the viewer back into STORY LAYER to read that story in more detail.

Clicking on one of the geographic points will bring the user into MAP LAYER.

### 3.4 Map Layer

In Map Layer, the user is allowed to view all of the cable networks connecting to a specific point. The user is not permitted an overall view of the entire network (as they are in the interactive Telegeography Submarine Cable Map), but must surf between different nodes via the submarine cables that link them. Their engagement is limited in order to keep them from finding the destination too quickly.



Figure 4: Map Layer

If the user clicks on a single node, then they move down into NODE LAYER.

### 3.5 Node Layer

In the final layer, users are able to view an individual site. For example, in Figure 5, the screen is centered on Bamfield, Canada. Here the user is given several images of the location, alongside contextual information.

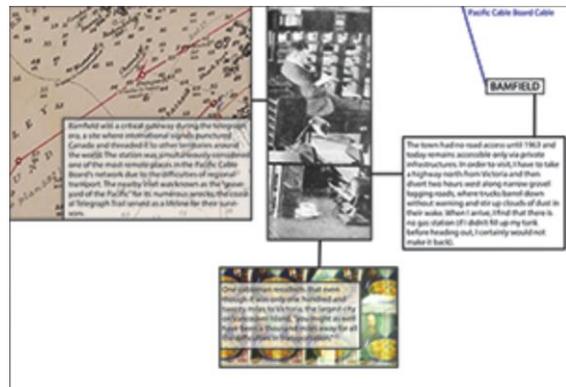


Figure 5: Node Layer

At Bamfield they might learn that the old telegraph cable station has now been renovated to become the Bamfield Marine Sciences Center (BMSC). Scientists at the BMSC are able to conduct marine research thanks to a new scientific fiber-optic cable, NEPTUNE, extending down the nearby inlet. In the future, the BMSC's research about the seafloor may benefit cable construction.

If the user clicks on the cable network, they will move up to MAP LAYER. If they click on one of the images, they will move back to the IMAGE LAYER.

While navigating through “Surfacing,” the user’s task is to find their way to a designated destination. As they traverse the network in search of this location, they will learn information about the social practices, technologies, and history of the cable industry. The specific paths users take and the information they acquire will reflect their own interests and is delivered to suit their pace. As they master this material, they will find it easier and easier to navigate to the destination. This interactive interface and game-structure can help to engage users who have not previously been interested in cable technologies.

#### 4 MINIMIZING RISK

“Surfacing” will employ strategies to ensure that the project minimizes any potential security risk. Visual information will be abstracted through the use of close-up shots. Information specifying the exact location of cable infrastructure will be left out, giving viewers far fewer details than existing websites such as SubmarineNetworks.com. When possible, locations will be designated as general areas rather than specific sites. While for maps built in GoogleEarth and GoogleMaps, all information is geographically locatable and has a reference point on an underlying grid, in “Surfacing” users are not allowed to zoom directly down into the actual surroundings of the cable network. Together these strategies mean that “Surfacing” will contain less sensitive information than industry and research websites.

#### 5 CONCLUSION

Protecting a commercial cable network in an Internet era must move beyond attempts to completely hide it. It is necessary to develop new narratives and new forms of visibility for these systems. The narratives included in “Surfacing” permit users to travel the route of the signal, and move between different cable environments, including cable stations, cable landing points, and islands. Because the information is structured in a dynamic and interactive way, users will be more likely to get a broad and diverse comprehension of cable systems than they would from websites that solely feature technical information. The networked nature of the data will also introduce them to a range of unexpected material.

The stories included in the project might be used in a variety of ways. Stories about conflicts at landing points could help in arguments for more cohesive national regulation of cable landings, benefitting the cable industry and national security. From the perspective of developing countries, stories about new or proposed networks such as the Tonga cable or Arctic Fibre might offer inspirational models for funding or obtaining government support. The histories of the system more broadly can help to cultivate a public understanding of the importance of submarine cables, not only in relation to networking today, but its impact on communication over the last 150 years.

#### 6 REFERENCES

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