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Caldwell Marine International: Installing Submarine Power Cables for the Next Generation

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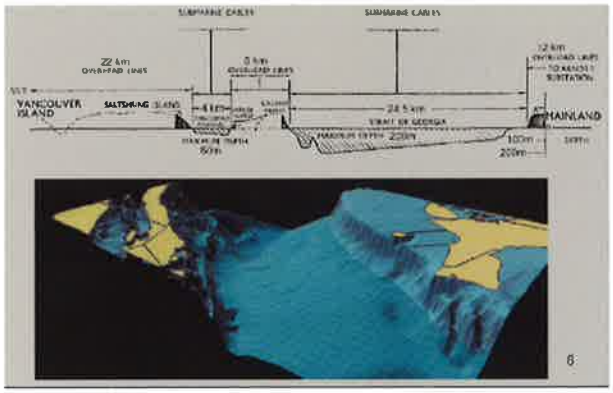
Cover Story

Installing High Voltage Submarine Power Transmission Cables for the Next Generation

By Troy Godfrey, Engineering Manager and Peter Jepsen, Project Engineer, Caldwell Marine International

Caldwell Marine International (CMI) completed, in 2009, the installation of 87,500 meters (54.4 miles) of high voltage submarine power cable in British Columbia (BC), Canada. CMI's sister company, Northeast Commonwealth Inc., contracted with Mitsubishi International to install the submarine cable plant for the Vancouver Island Transmission Reinforcement (VITR) project. The $295-million VITR project replaces an aging 135 kV transmission cable with a new 600MW-242kV system which will provide Vancouver Island and the Southern Gulf Islands with safe reliable energy into the future.



VITR Transmission Route and Bottom Profile

The Scope of Work included the following:

- Marine Route Survey
- Cable Route Engineering
- Coordination and Logistics of a Multi-national Project
- Extensive Documentation, Reporting, & Quality Management
- Transportation of the 6,000+ metric ton Submarine Cable Plant from Japan to BC
- Installation of the Cable Plant
- Specialized Environmentally Friendly Burial Through Eel Grasses

The cable system consists of two submarine crossings, Trincomali Channel and the Strait of Georgia. Each crossing is comprised of three 242kV single core fluid filled (SCFF) submarine power cables.

The Trincomali Channel crossing runs from Montague Terminal (MTG) on the west side of Parker Island across Trincomali Channel to the Maricaibo Terminal (MBO) on the eastern shore of Salt Spring Island, an approximate cable distance of 4.1 km.

The Strait of Georgia crossing starts at the English Bluff Terminal (EBT) in Tsawwassen, BC, and crosses the Strait of Georgia to the Taylor Bay Terminal (TBY) on the eastern shore of Galiano Island, an approximate cable distance of 24.8 km. Of particular interest is the crossing of the "Galiano Ridge" an undersea mountain, which rises from 190m to 50m water depth then down to 150m over a horizontal distance of ~400m. The steep ascent and descent required considerable engineering and site investigations prior to the installation.

CMI transported the cable plant in the 28,000 dwt handy bulker INDIGO OCEAN and then installed each segment of cable from a shallow draft self propelled DPII Cable Lay Barge With the INDIGO OCEAN, (freighter), serving as a floating warehouse, each cable segment was transferred from the ship to the Cable Lay Barge, then installed.

Cable Freighter "Indigo Ocean"

Cable Lay Barge

CMI chartered a heavy built deck barge, the SEA-SPAN 201. The 201 was chosen for her ability to accommodate a large diameter static cable tank, the heavy deck loading of the cable plant, and her ABS classification.

Caldwell Marine International's "Seaspan 201" DP-II Cable Lay Barge Loaded with 1600tonnes of Cable

CMI's dynamic positioning system (DP II System) was installed on the barge. The DPII system is a computer controlled propulsion system utilizing thrusters to maintain the barge's position in open waters against wind, wave and current conditions. The computer calculates and controls the amount and direction of thrust required from each of four thrusters in order to maintain position, heading and course during lay operations.

Cable Loading at Factories (Japan)

Each of three static cable tanks was erected in dedicated holds in the freighter by CMI's subcontractor in Japan. Then, each of the three Georgia Strait cables (GS1, GS2,

and GS3) were coiled into the tanks, with the Trincomali channel cable coiled on top of the GS2 cable.

Cable Offloading onto Lay Barge

Following the transit from Japan to Vancouver Island, the cables were loaded on the cable lay barge. The cable transfer procedure involved pulling the cable from the tanks in the hold of the freighter and coiling it in the cable tank on the lay barge

On the lay barge, the cable passed through an overboard chute (OBC) then entered a linear cable engine (LCE) which pushed the cable to the top of the gantry. The coiling arm then coiled the cable in the tank on the barge.

Cable Installation/Trincomali Channel

The installation across Trincomali Channel involved an initial landing at the Montague (MTG) terminal and a final landing at Maracaibo (MBO). The crossing of the channel was fairly benign with no major high relief features.

At the initial MTG landing and the final MBO landing, the cables were floated to shore from the barge to a chaseway then pulled up the chaseway through the terminal to the potheads.

Through out the cable installation, our proprietary PLOW 2008 cable monitoring system was used to create a model of predicted cable tension, angle and touchdown point versus bottom depth for each of the Trincomali Channel routes.

Initial Landing Operation

Following the cable landings, split pipe installation and jetting burial to 1m by divers took place (land fall sites only). An ROV as-laid inspection of all three cables was then carried out.

Caldwell Marine International's Low Impact Eel Grass Injector

Cable Installation/Georgia Strait

The installation of the three 25km cable segments in the Georgia Strait was carried out in three phases.

The cable route was designed to minimize any disturbance to the environmentally sensitive eel grasses growing in the tidal flats.

To minimize disturbance, a low impact Eel Grass Injector (EGI) tool, a unique Caldwell Marine designed and built burial tool, was used in these critical fish habitats.

This tool was developed by Caldwell as the result of years of experience working in environmentally delicate areas, coupled with the ever growing need to maintain environmental awareness when undertaking installation projects of this magnitude.

At the completion of the eel grass burial, the injector blade was eased to the surface as the barge progressed ahead, the cable was removed from the injector blade and allowed to float toward the barge.

A workboat with a DGPS system and divers were used to ensure that the cable was on the route prior to deflation of the flotation system. With the cable on the seafloor, the cable laying commenced across the Georgia Strait.

Galiano Ridge

The Georgia Strait crossing was timed to reach the Galiano Ridge at minimum modeled current conditions.

As the cable lay barge approached the ridge, the speed was reduced. If a span was observed by the ROV, the barge was stopped until the length and nature of the span could be confirmed and an inspection of the seafloor could determine if an alternate route was feasible.

If so, the cable was recovered and reinstalled along the preferred route.

Taylor Bay (TBY) Final Landing

Aside from excavation work required due to a boulder field at the entrance cove at Taylor Bay, the final landing at TBY followed the same general procedures for each of the cables without incident.

Final Landing Operation

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