COMPOSITE contends with Arctic underwater pipeline repair

Composite technology is proving to be valuable in repairing critical infrastructure in exacting environments. By Buddy Powers and Martin Pashuck, ClockSpring|NRI

Team members on the barge applied filler and adhesive to the Snap Wrap repair sleeves and placed them on the frame developed specifically for this underwater installation.

Maintaining pipeline integrity in exacting environments poses significant challenges, particularly in high-traffic areas offshore. When the pipeline is in an ecologically sensitive region and is difficult to access, the challenges are compounded.

A pipeline owner in Alaska encountered a series of obstacles when the decision was made to address damage on 20 girth weld joints on a 10-inch (25.4-cm) gas pipeline in Cook Inlet. The line needed to be repaired, but there were a lot of variables that had to be taken into account in determining how the line would be restored.

There is considerable marine traffic in the inlet, and the work would need to be done from a floating structure with station-keeping ability that did not require mooring.

Subsurface conditions also posed difficulties. There was zero underwater visibility at the repair site 100 ft (30.5 m) below the surface, and there was very little clearance between the lines. The concrete coating on the pipeline was 2 inches (5 cm) thick, which in some cases left only 2 inches (5 cm) of clearance.

The work window posed another challenge. The project would have to be executed during the summer months and during slack tides, the short time window during which there is no movement either way in the tidal stream – before the direction of the tidal stream reverses.

Finally, the owner needed a solution that would not require the pipeline to be moved and would deliver long-term performance at the maximum operating pressure (MAOP) of 2,785 psi (192 bar).

The installation variables and the required specifications led the owner to ClockSpring|NRI, where experts suggested using Snap Wrap, a multi-layered composite repair system made of high-strength, corrosion-resistant fiberglass split sleeves. This repair system is ideal for areas with tight access and is designed to permanently reinforce corroded and damaged pipeline systems. It is installed with a high-performance adhesive and a filler material and is fitted to the pipe without the need for cutting or welding.

Preparation

Once the repair was selected, a team needed to learn how to perform an installation. Training was carried out in Houston for the diver who would perform the Snap Wrap repair during a weather window in late May to early June, when the water temperature in the inlet would be approximately 43°F (6°C), the minimum application temperature threshold for the composite repair.

A barge carried the diver and support team to the worksite. Installation was scheduled to take place during slack tides, which occur every six hours, giving the diver bottom time of approximately 25 to 40 minutes. Because the

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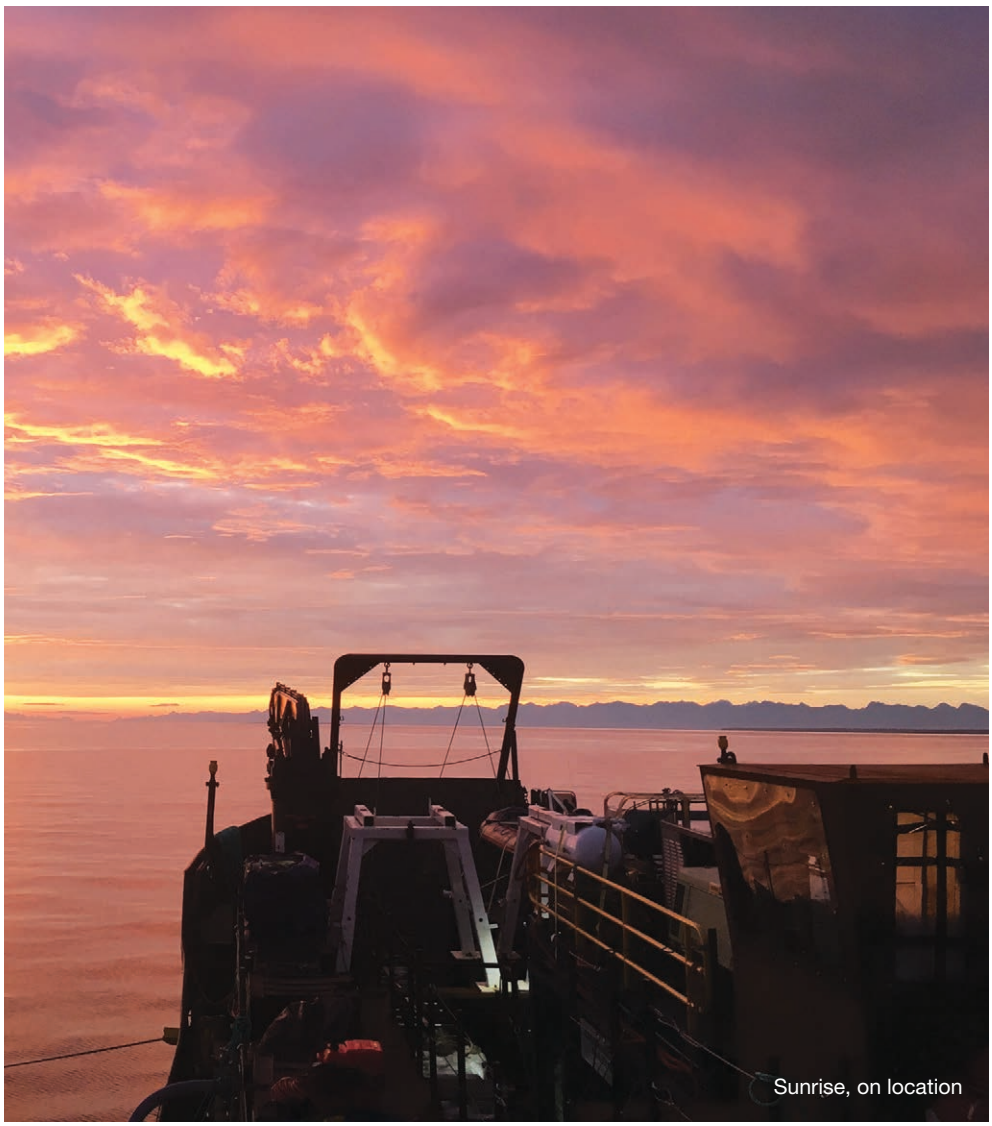


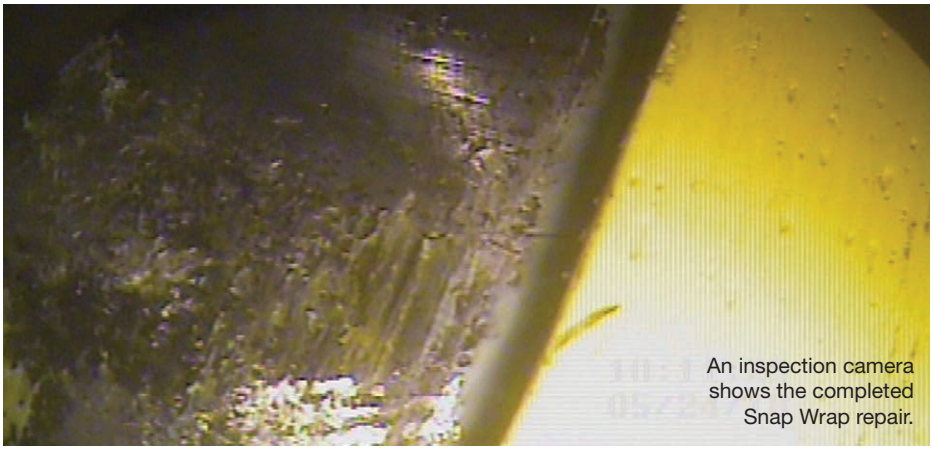
Sunrise, on location

tide flow deposits glacial silt, the diver would need to clean the pipeline before each step of the installation to be sure the adhesive functions as needed to properly secure the Snap Wrap to the damaged area of the pipeline.

One of the application criteria was that each sleeve installation had to be completed during a single operation because anything that was only partially installed would have to be retrieved and discarded. To mitigate waste, the team trained on the deck before the installation began so every step could be carried out as efficiently as possible.

In onshore installations, the filler and epoxy are placed on the repair area, and the sleeve is clamped on over top. Because this installation was being done under water, the filler and epoxy had to be placed on the sleeve and carried by the diver to the repair area, where the sleeve would be secured to the pipeline. The team on the barge had no difficulty making up the sleeves for installation, but the lone diver faced challenges placing the Snap Wrap on the pipe following the normal installation process with zero visibility.

Creative thinking led to a solution. The diver descended to the pipeline, located the girth weld, and loosely installed band clamps before and after the repair area so it would be easy to find the correct landing spot for the composite sleeve. Meanwhile, the team created a frame that could hold the prepared split sleeve in the open position during the dive to make placing it on the pipeline much easier. Using the frame and ties cut the application time in half, which made the installation process much more efficient.



An inspection camera shows the completed Snap Wrap repair.

Execution

During each dive, the installer inspected the pipe to determine how much room there was to install the composite sleeve and cleaned the area to ensure the repair sleeve would adhere to the pipe. The next step was to loosely install band clamps above and below the repair area. Picking up a prepared repair sleeve at the surface from team members on the barge who had applied filler and adhesive material, the diver descended with the sleeve and used the specially designed tool to place the Snap Wrap sleeve on the pipeline, orienting the seam 180 degrees from the primary defect and tightening it to extrude any excess filler.

Wiping the excess filler from sides of sleeve, the diver moved the band clamps to the next repair area, cleaned excess hardened adhesive from the outside surface of the Snap Wrap sleeve, and placed wrap ties around the finished repair to hold it firmly in place while it cured. With the installation complete, the diver could return to the surface to pick up the next prepared sleeve.

The diver repeated this process, placing each sleeve with the seams oriented 90 degrees from the previous one. He inspected the sleeves to ensure proper curing, then installed Contour WA, a proprietary composite solution with engineered, bi-axial stitched e-glass tape impregnated with a water-activated polyurethane resin, to the remainder of line for impact protection. During each session, the diver made as many dives as possible before tide conditions prevented further work.

Following this work programme, the diver repaired all the damaged girth welds and restored the line to safe working order.

Taking the next step

Understanding the unique site conditions and being willing to develop alternative ways of installing the products led to a novel application in challenging underwater conditions. The installation team learned some valuable lessons from this project that will lead to further improvements for harsh environment installations.

The willingness to attempt this type of installation for the first time took trust and cooperation. Although the composite technology had proven effective on many previous projects, none had delivered the number of challenges presented by this offshore repair. This solution proves the applicability of composite solutions in water in cold conditions and illustrates the adaptability of the technology. FE

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