

Case Study:

Crowley Shines during *Kitchen Lights* Installation



▶ In late summer 2015, Crowley's marine solutions team completed the successful installation of customer Furie's *Kitchen Lights* natural gas production platform and underwater pipeline in Cook Inlet, Alaska. The project, which spanned two years from planning phase through completion, was the most recent project in which Crowley served as the prime contractor. It resulted in an incredible amount of engineering and preparation; nearly 300 on-site, contracted workers; up to 20 support vessels, both Crowley-owned and chartered; and loads of innovative thinking.

Above: A view of the project site in Cook Inlet, Alaska.
Below: Currents in Cook Inlet race by moored vessels at 12 feet per second when the tides changed.

“ We’ve been in Cook Inlet for 60 years. Our marine ops personnel know exactly how difficult it can be. This is what our team is built for.”

The currents raced underneath Crowley's *Nilnilchik* barge at seven knots – nearly 12 feet per second – giving the employees aboard a sense of motion despite their moorings. The calm, summer morning had shifted into an angry afternoon, with heavy chop and cold, 30 mile-per-hour winds that sliced through jackets and gloves.

Tides in Cook Inlet, Alaska, where the *Nilnilchik* was stationed, are renowned for their extremes, rising and falling by up to 35 feet every six hours. The currents change so frequently and so quickly that ice never has the opportunity to fully form on the surface during the winter. The milky waters are also loaded with glacial silt, making visibility non-existent and equipment erode at warp speed. Rumor has it that if a five-gallon bucket is dipped beneath the surface, an inch of silt will settle to the bottom.



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Left: Two of the nearly 20 vessels deployed by Crowley for the project. **Below:** Hundreds of Crowley-contracted employees ensured success.



leading naval architecture and marine engineering firm based in Seattle. Hundreds of thousands of engineering and planning hours were logged, all in preparation for the ice breaking, which marked the project's start, in early spring.

Part of that preparation included the acquisition of specialized employees and assets. More than 300 workers, mostly third-party contractors, were hired in advance – experts from around the world in engineering, diving, offshore oil and gas, and others – and nearly 20 vessels, a combination of Crowley-owned and chartered assets, were reserved and outfitted for the project.

“It was a fast-tracked project,” explained Furie’s Oliver Arnold, project manager. “But it was a very strong team, perfectly suited for the endeavor.”

“We had two 8,000-HP, anchor-handling tugs, each capable of a 3,000-HP of side thrust, which made this work possible in the strong current,” said Crowley’s Russel Luttmann, senior project manager. “Additionally, Crowley had at least four offshore supply vessels operating at any given time, two dive support vessels, a crew boat, several offshore and harbor towing vessels, several barges,

Yet, the Crowley team, alongside hundreds of contractors, worked tirelessly. The warm-weather window to complete their mission was short: ice in the surrounding waters would complicate their exit if they didn’t meet the project deadline of late summer. Around-the-clock shifts were aided by nearly 24 hours of continuous daylight, but even so the hours passed quickly.

In Alaska, every project is a race against time.

The story began the year before, when customer Furie Operating Alaska, LLC, requested support from Crowley for the installation of a natural gas production platform and underwater pipeline in an undeveloped natural gas field in Cook Inlet. Crowley was chosen as the prime contractor strategically because of its more than 120 years of project experience, much of it in the harsh Alaskan environment. The company also had the resources, many in-house, to pull off the extraordinary.

Cook Inlet stretches 180 miles from the Gulf of Alaska to Anchorage in south-central Alaska, almost surrounding the capital city. It is regarded as the birthplace of commercial oil and gas production in Alaska. Since the discovery of oil in the area’s Swanson River field in 1957, Cook Inlet has produced over 1.4 billion barrels of oil, 5 trillion cubic feet of natural gas and provided important tax and other revenues for local and state governments, according to inletkeeper.org.

Furie’s interests in the area have included drilling both exploratory and development wells. But for the summer of 2015, with Crowley’s support, Furie aimed to install a platform, pipeline and onshore production facility, called *Kitchen Lights*, with production commencing in the fall of 2015.

The year leading up to that summer passed quickly for the project team, which included experts from Crowley and its subsidiary Jensen Maritime, a

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man overboard/security vessels and a landing craft. It was a wide variety of vessels that the company coordinated.”

One of those vessels, the company’s *Nilnilchik*, was outfitted as a pipe-laying barge, complete with on-board stations to facilitate the assembly of nearly 16 miles of 10-inch, concrete-coated pipe. On the stern, a 160-foot, steel stinger structure was installed to guide the readied lengths of pipe gently to the sea floor.

“We had to get the barge designed and assembled, and also the stinger built, which Crowley had fabricated for Furie in Vancouver,” said Jensen’s Courtney Bradbury, project engineer. “That was kind of like commissioning a brand-new vessel in about six months ... it was a big challenge.”

The heavy lift barge 455-8, also a Crowley asset, was reserved for the transportation of Furie’s *Kitchen Lights* platform and other equipment from the fabrication site in Texas.

Included in the contracted vessel fleet was SAL’s *M/V Svenja*, a vessel Crowley

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had previously chartered during the unprecedented – and successful – *Costa Concordia* wreck removal project in Italy. For Furie’s job, it was outfitted in Singapore with extra quarters for 60 team members who would live and work aboard for nearly five months.

“It was a general cargo vessel instead of an offshore installation vessel, which meant we had to outfit it for the kind of work we were doing,” explained Bradbury.

Because the ship is foreign flag, special considerations were also taken.

“It was necessary to design and calculate special mooring arrangements for *Svenja* to fully comply with the U.S. Jones Act and, at the same time, to guarantee an accurate positioning of the vessel in extremely strong tidal currents and with small tidal windows to work

in,” said SAL’s Karsten Behrens, general manager, engineering, heavy lift.

“Jensen designed the 10-point mooring system. That was rather robust,” added Bradbury. The concept involved special anchors brought in from Holland and additional ballasting.

Another critical asset was the *Svenja*, which was reserved for the lifting of the monopod, a cylindrical or caisson-type of offshore platform support base that measured 18 feet in diameter, from the 455-8. The *Svenja*’s two, on-board cranes later positioned the base accurately on the seabed.

The remaining chartered vessels included dive ships, grout barges, boats that ferried workers to and from the project site and powerful tugs.

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Crowley's Ocean class tugboat *Ocean Wave* and heavy-lift barge 455-8, along with other specialized support vessels, transport the *Kitchen Lights* monopod up the West Coast to Alaska.



Below: The project piles loaded on the barge prior installation.



Other considerations before the project start included managing the unexpected.

"In 2014, Furie's plan was to have piles driven 120 feet into the seafloor. Upon further review of the foundation design, it was determined that we needed to add an additional 80 feet to each of the eight piles, which sounds like a pretty easy task until you realize they're 42 inches in diameter and 2.5-inch thick, steel-wall tubes – which are not easy to weld. And each was already laid out on a barge ready to go north. So, we unpacked everything, cut the piles into pieces and reassembled them back into the installed lengths. That was a big technical and logistical challenge. We did all that in the two months before the monopod left. It initiated a significant fabrication phase, but we handled it without delay."

And then, just like that, spring arrived and the project began.

April 2015

The high-bollard, specialized tugs ensured the *Kitchen Lights* platform and monopod's safety as they departed Seattle for Alaska in April, as soon as the weather and ice allowed. The envoy's

trip up the West Coast took about a week, without issue.

Upon arrival in Cook Inlet, the challenges – and creative solutions – began immediately.

In the first phase of work, a central pole, called the king pile, was installed, serving as the focal point for the structure's installation. Next, the monopod, or platform base, was lifted from the 455-8 and onto the deck of the *Svenja* for final preparations. When ready, it was placed over the king pile and well conductor, and lowered precisely on the sea bottom by *Svenja*'s two 1,000-ton cranes.

"We could only operate when the tide was not running full force. Lifting the monopod for placement ... we could only do that during a very small window when the tide was flat," said Crowley Vice President Johan Sperling.

With the monopod submerged, the king pile, which stood high above the water, now also served as a marker for the location of the hidden, underwater structure.

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Above: The monopod was lifted by Svenja's two 1,000-ton cranes and lowered precisely on the sea floor. **Below:** Piles are hard-driven 200 feet into the sea floor via a specialized hydraulic impact hammer.

Next, the surrounding piles had to be driven 200 feet into the hard seabed with a specialized hydraulic impact hammer. And because the piles were too tall for any single crane to manage, innovative thinking was required.

To tackle the task, a specially designed, Platform Drilling and Driving Deck (PDDD) was fitted to the top of the monopod. Then, each section of pile was driven down through the platform, followed by another that was welded in place. This was repeated until all four segments were joined to form the full pile, and all were in place.

The final layer added was the topside, installed on the main support frame. The main support frame was a 250-ton structure with 3.5-inch thick, steel walls that had been welded on site around the large diameter of the monopod before it was submerged.

"The topside installation was very tight and tide dependent. The installation window was open for about four hours," reported SAL's Rüdiger Bauer, corporate director, engineering and ship management.

Perhaps the biggest challenge of the entire project – in addition to the ever-changing tides – were the black-water conditions. The inability to see subsea presented problems for both divers and prevented the use of Remote Operated Vehicles (ROVs). To manage this problem, Crowley's project managers instead installed echoscopes on the stern and bow of the *Ninilchik*, which gave them the ability to map the work site via sonar.

This was especially important because the seafloor in Cook Inlet is uneven and littered with glacial boulders up to six meters in diameter. The echoscopes allowed project managers to avoid such large obstructions and identify significant undulations in the seabed.

But before the pipes could even be mapped along the bottom, they had to be prepared on the *Ninilchik*. Aboard the pipe-laying barge, four stalls and

Below: Lengths of pipe were loaded onto the "firing line," which funneled the segments towards the stinger on the stern of the barge. **Bottom:** Every 20 minutes, a new length of pipe was guided down the stinger into the water.



a conveyer formed an assembly line, called the "firing line" by the workers, to funnel pipe from bow to stern, towards the stinger. Along the way, the pipe received treatments such as root pass, filler welding and capping, X-rays to check for imperfections and protective coatings before they were eased into the water.

"For the *Ninilchik* to move forward to lay sections of pipe, the barge's anchors had to be repositioned at the rate of 12 to 16 anchor drops per day, totaling over 350 anchor drops for the operating season," explained Luttmann. "All this was done despite the prevailing strong currents in the region."

"Every 20 minutes, a length of pipe was moving to the next stall and another was going over the stern," said Bradbury.

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But the undulating contours provided additional problems for pipe-laying operations. The stiff lines of pipe straddled the peaks, creating unsupported bridges over the dips, leaving some sections unsupported. This required divers to blindly perform span mitigation techniques, or laying grout underneath the suspended sections for support and to reduce vibrations during active pumping.

"You can only dive every six hours, for half an hour, because of the tides. So that, along with the black-water conditions, was another major technical challenge that we were able to manage," said Bradbury.

Despite the challenges, Luttman reported that Crowley averaged, "... approximately 2,500 to 2,600-feet per day of pipe laid on bottom."

Throughout it all, safety was top priority for the workers.

"I was very impressed with Crowley's health and safety presence," said Arnold. "The safety teams pushed us to think about safety every day and make it a priority as we worked."

A Job Well Done

By August, the Crowley-led team had installed the *Kitchen Lights* platform, pipeline and onshore production facility, which included nearly 16 miles of pipeline stretching from sea to shore.

Furie is working to secure gas supply contracts that will support an initial production rate of 85 million cubic feet per day, although the field appears to be capable of significantly higher rates than that. This new activity could reflect a resurgence of activity for the region, following this successful, safe and incident-free project.

"This was a big milestone for Furie, but the real success story here was in the teamwork," said Arnold. "We had to overcome many challenges in Alaska, but it was done very quickly and quite effectively. There was good cooperation and it was interesting to see how

Crowley approaches challenges and solves problems."

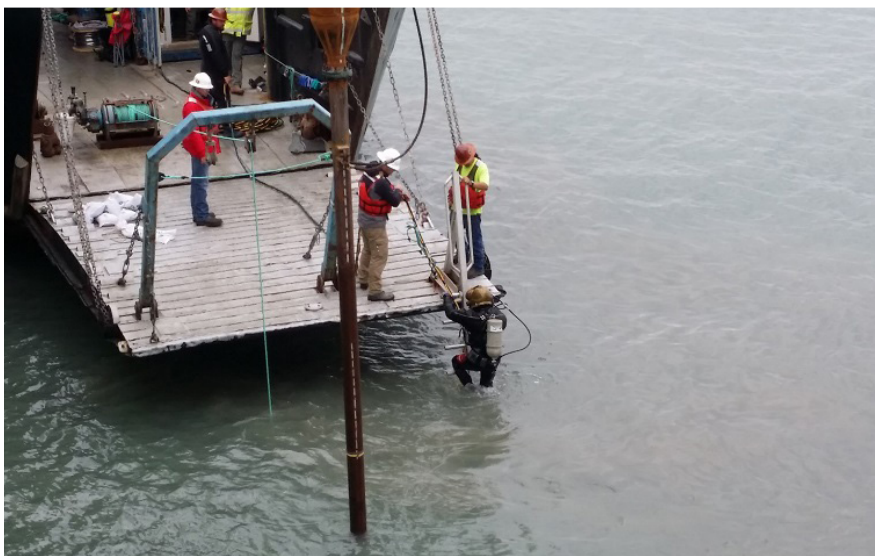
"We've been in Cook Inlet for 60 years," said Sperling. "Our marine ops personnel know exactly how difficult it can be. This is what our team is built for."

"It's the first of its kind project – soup to nuts – for Crowley," said Crowley's Rebecca Hamrick, director, marine solutions. "But it proves that our people are some of our greatest assets in an arena where we are known for our equipment. I believe that we have just proven that we have the ability to gather assets and brain power from all over the world to accomplish a project of this size. I don't think that another company could have done what we did."



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Crowley's marine solutions capabilities at crowley.com/marinesolutions.



Above: Divers could only work thirty minutes every six hours due to tides, in challenging black-water conditions.