

# A lighter heart for a heavy lifter

NOV designs and builds the most durable and energy efficient fiberglass ballast system of the world's largest vessel in its class, providing lifetime protection from seawater corrosion.

5

Five miles of fiberglass piping in the corrosion-resistant ballast system

1.42

1.42 million pounds saved by using fiberglass vs. steel

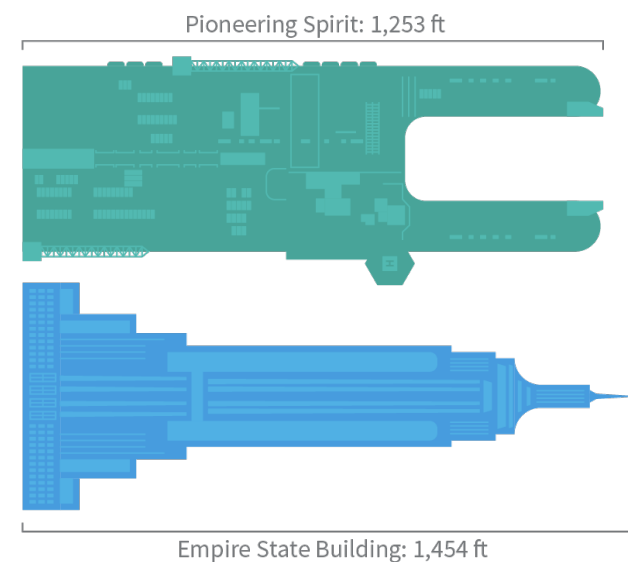
\$50

\$50 million potential repair costs saved

Saltwater corrosion is the silent enemy of every seagoing vessel. Average ocean salinity is 3.5 percent, producing metal-eating corrosion rates as high as 2.5 inches/60 millimeters per year. Salt exposure is unavoidable: it flows through ballast pipes, splashes external surfaces and fills the air.

Pioneering Spirit was designed to thrive in ruthless ocean environments. This one-of-a-kind vessel performs single-lift installation and removal of large offshore oil and gas platforms, along with installation of oil and gas pipelines. A series of horizontal lifting beams can install platform topsides weighing 48,000 tons/43,545 tonnes all in one piece and remove 25,000-ton/22,680 tonne rig jackets in a single lift.

Measuring 1,253 feet/382 meters long and 407 feet/124 meters wide, Pioneering Spirit is almost the size of a floating Empire State Building. At its deepest draft it reaches a world-record displacement of one million tons of seawater, making it the heaviest floating object on Earth.



With measurements like these, pulling into a dry dock for repairs isn't a practical option. The challenge was to build Pioneering Spirit with lighter materials that stopped salt corrosion before it could start.

Allseas commissioned NOV Fiber Glass Systems to build a maintenance-free ballast system to protect their \$2.9 billion/€2.6 billion investment. After intensive review of design specifications, the Bondstrand 2000M pipe series was selected for its corrosion resistance, toughness and temperature performance. With a projected lifespan of five decades or more, the ballast system will last for the life of the vessel and beyond.

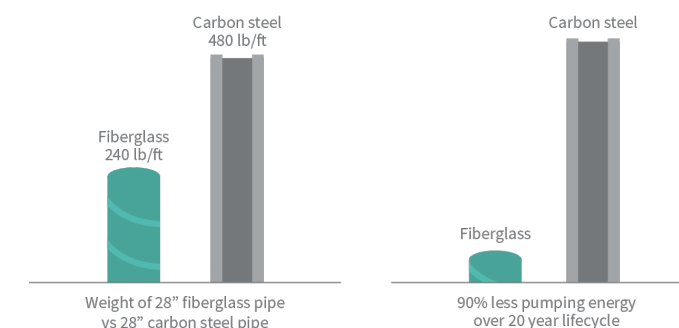
Using detailed pre-design analysis, Fiber Glass Systems produced almost five miles of custom fiberglass pipe of various diameters, along with 11,000 fittings. "Just-in-Time" technology delivered materials to the building site right before installation. This approach prevented exposure damage while the pipe spools were in the shipyard, freeing up precious yard space and eliminating warehouse costs.

The end result was a tough, maintenance-free ballast system that serves as the "heart" of this massive vessel. Resolving the



threat of corrosion eliminated the need for periodic inspections of bulkhead penetrations. Time and labor costs were reduced, preventing cumbersome, expensive maintenance and schedule delays.

Pioneering Spirit could not have been built at its current size without the weight savings and smooth fluid flow benefits of fiberglass pipe. For example, a single foot of the 28-inch fiberglass pipe supplied for the ballast system weighs 240 pounds/109 kilograms, versus 480 pounds/218 kilograms for the same length of carbon steel pipe. Multiplied throughout the ballast system, this trimmed almost 1.42



million pounds/645 metric tonnes. Larger-bore carbon steel pipes would have been required for the same throughput of water, so Pioneering Spirit would have needed 48-inch steel pipe, rather than 40-inch fiberglass pipe.

A steel pipe ballast system would have experienced seawater corrosion almost immediately, requiring costly repairs. Pipe replacement has an estimated labor cost of \$500/€443 per foot, not including materials and downtime. Selecting the Bondstrand 2000M pipe potentially saved \$50/€44 million in labor cost alone to replace corroded ballast pipe.

Fiberglass is also a kinder choice for the environment. It eliminates the waste and disposal of replacing steel pipe, saving up to 80 percent of the energy required to produce new steel pipe. The smoother inner surfaces require less pumping energy, providing up to 90 percent of energy savings during a 20-year life cycle.

The corrosion-free ballast system forms the strong, pumping heart of the Pioneering Spirit. With a life expectancy of more than 50 years, this heart will definitely go on.