

PFlow navigates uncharted territory with vertical lift at Norfolk Naval Shipyard Drydock



- F Series 4-Post Mechanical Lift
- Lifts Loads up to 25,000 lbs.
- 52' Vertical Rise
- 2 Levels of Vertical Rise
- 30 FPM Travel speed

At just over 1,092 feet in length Dock #8 is the largest of the seven drydocks at the Norfolk Naval Shipyard (NNSY) in Portsmouth, VA. Opened in 1942, it is also the newest to hold aircraft carriers, the largest ships in the naval fleet and among the largest mobile objects of any kind in the world.

As part of a refurbishment, Dock #8 added a large, intricately designed vertical reciprocating conveyor (also known as a VRC or vertical lift) made by PFlow Industries. The US Navy commissioned the VRC to move materials and equipment used to build, repair and modernize the Navy's largest ships to and from the top and bottom of the drydock.

Previously a large overhead crane had been used to move equipment and materials, but each move required numerous planning sessions, extensive safety measures and a ten-man team to execute. Seeking a far simpler solution the Navy turned to PFlow who had designed a similar, though less complex material lift for their shipyard in Puget Sound years earlier.

STRUCTURAL INTEGRITY

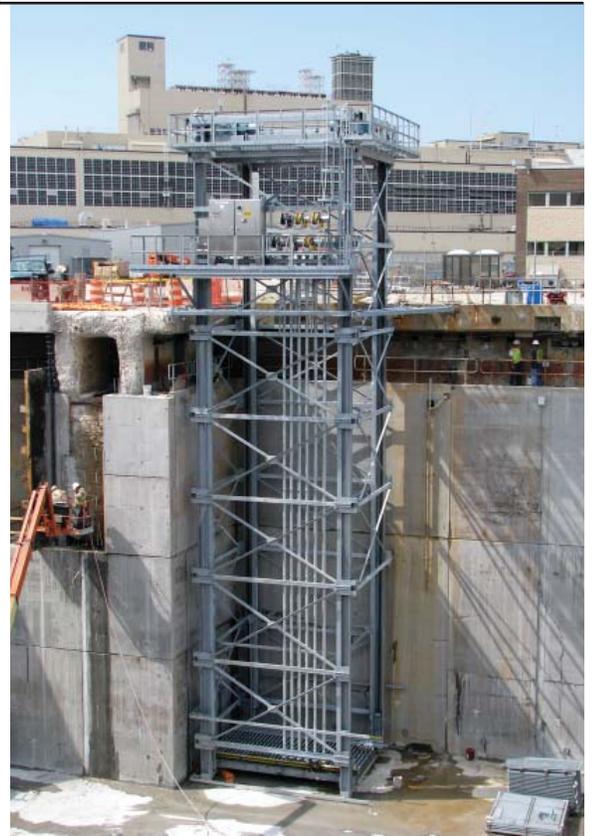
Due to the harsh marine environment, every metal part was hot-dip galvanized (HDG), and most non-metal parts are polycarbonate, UV resistant plastic. All other components, including controls, cables and electronics were designed and specified to withstand extensive saltwater exposure.

The entire lift is a completely bolt-together structure, with no major structural welds. This 1) helped to transport the lift in assembly-ready pieces from the PFlow Milwaukee production facility to Norfolk, 2) allowed the largest metal parts to be small enough for the HDG process, and 3) significantly enhanced the VRC's structural strength without adding excessive rigidity.

Depending on the ship or the area of the ship being worked on, there are two alternate positions within the dock where the VRC can be positioned. When a ship enters and exits the dock, the VRC is designed to be lifted out of the dock. This requires the 40-ton unit to be structurally secure enough to be lifted as a single piece by a crane and moved from one position to the other or out of the drydock entirely. The selection of the appropriate steel; the number, grade and position of the bolts; and the installation of the controls and moving parts had to be flawlessly designed and executed.

DESIGN INNOVATION

In rare instances when there may not be time to remove the VRC from the dock floor there is a four hour emergency turnaround design contingency. If a ship comes in with limited notice, the lower conveyor section is removed and six manual cable reels made of custom marine designed stainless steel are used to move the detachable electrical components above the water level. Lockable storage boxes are provided as a convenient place to house the detached electrical components.



The drydock can then be flooded with 50' of water and the VRC will be operable once the ship has entered, the dock is drained, and the components reattached. The top section of the VRC can be lifted and removed for easier maintenance on the motors, gearboxes and other components that drive the lift. A catwalk is installed at the very top of the lift for access to these parts for more routine maintenance.

Loads are placed on a heavy duty metal pallet and moved on and off the VRC platform on both levels via chain driven live roller (CDLR) conveyors that extend from the lift at both levels. The actual lift platform also has a CDLR conveyor with photo eyes that control the movement of the load to assure that it is securely positioned in the middle of the platform. A scale verifies that the load is within the weight limit and tie-down rings and straps on the metal pallet can be used to hold the load in place.

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Panels at both levels house the individual controls that begin the movement of the rollers and initiate the vertical movement of the platform. A navy phone with hand powered crank is also installed at both levels to allow operators at each level to communicate as needed.

ENGINEERING SOPHISTICATION

PFlow created and refined the entire design on SolidWorks utilizing Solid Modeling techniques. Solid Modeling allows for 3D exploded views of all areas of the VRC structure, and automates many difficult engineering tasks and calculations.

“This system was designed from the ground up using SolidWorks solid modeling software. Using the 3D model PFlow engineers were better able to visualize the relationships between the many components of the system including the drydock itself, reducing or eliminating potential errors due to interference between the components,” said Mark Webster, PE, PFlow VP of Engineering. “The ability to quickly convey concepts during design review meetings and the ability to make changes on the fly to a very complex design resulted in a more refined design that was completed in a fraction of the time it would have taken using conventional 2D CAD.”

A product data management (PDM) system was also used, providing the communication and project transparency necessary for multiple engineers to work on different areas of the VRC. PDM also tracks and controls project data such as technical specifications of the product, specifications for manufacture and development, and the types of materials that will be required to manufacture the VRC.