



JARVICE[™] and the Nimbix Cloud enable newcomer MiNO Marine to penetrate a crowded market with a totally new vessel design in less than 12 months



"MiNO Marine's diversification strategy required penetrating a mature market of well-respected ship designers and builders, so we needed to design more than just another towboat. JARVICE[™] and the Nimbix Cloud accelerated our analysis capabilities in computational fluid dynamics, allowing us to deliver an all-new hull design based on modern engineering techniques. Ultimately, that differentiator sold our design to the market, and we had these new boats under construction inside a year."

David M. Bourg, PhD PE Founder and Managing Partner, MiNO Marine LLC



INTRODUCTION

A naval architect and marine engineer, David Bourg worked in shipyards in the Gulf South region for years until 1997, when he started his own engineering and software development company. Today, MiNO Marine, LLC, performs full spectrum ship design, from blank pieceof-paper to production engineering, primarily for the offshore and oil and gas market. Recently the company has diversified into more specialized crafts, including high speed vessels, self-elevating boats for offshore wind construction and maintenance, dredging, and-most notably-inland river craft. Engineering design for river towboats hadn't changed much in decades, and the major players had become comfortable. To break into this market, MiNO Marine had to develop a fundamentally different ship design. For that, he needed the resources of an HPC partner like Nimbix.

CHALLENGES

Vessel design and engineering at MiNO requires advanced high-end analysis involving simulations of hydrodynamics, seakeeping analyses, and resistance and power analyses. MiNO leveraged a computational fluid dynamics software, Star-CCM+, to help with ship hull design, allowing them to optimize hull forms for resistance, minimize power required to push the vessel through the water, and solve even more difficult problems like seakeeping and estimating the massive forces generated by impacting waves. However, Bourg knew that the sheer computing resources needed to run these simulations far exceeded that of the firm's desktop computers. The simulations would run for days, lengthening the time required to complete and deliver their clients' projects.

In addition, MiNO didn't want to invest in its own HPC cluster, only to have it sit idle when not needed. For one thing, HPC servers were cost prohibitive for a company of MiNO's size. Plus, the MiNO team were scientists and engineers, not infrastructure experts, and keeping such a costly investment up to date wasn't something they were equipped for. To deliver real value to its customers, MiNO needed a cost-effective, high performance computing platform to speed up its simulations and analyses, without the burden of having to maintain it on its own.

TECHNOLOGY USED

MiNO Marine used the Nimbix Cloud powered by JARVICE to accelerate the execution of simulations using the Star-CCM+ program and then analyze the results of its simulations. This HPC application accurately simulates the behavior of fluids, liquids, and gases as they interact with solid boundaries—such as the hull of a ship or an offshore drilling platform—as well as modeling heat transfer and other physics. Running Star-CCM+ within the Nimbix platform, MiNO can simulate the flow of water around a ship as it moves through both seawater and fresh water, as well as the pressure and impact of waves of differing intensities. This allows MiNO's engineers-designers to model the ship accurately and geometrically, accounting for variable properties like mass/weight, shape, and center of gravity—without the need to create potentially hundreds of physical prototypes.

The result is the accurate assessment of pressures that are acting on the ship under different conditions, as well as how much force is required to drive a ship through the water at a certain speed. From there, the team can alter the design geometry of the ship to improve its performance, maximize safety, and minimize the power required to propel it forward.

ENGINEERING SOLUTION

Since outsourcing its HPC computing infrastructure to the Nimbix Cloud, MiNO has been able to accomplish ship design feats that rival competitors many times its size. Nimbix allows MiNO engineers to focus their attention on what they do best—ship design—rather than on maintaining an HPC infrastructure that can provide the speed, ease-of-use, and cost effectiveness they need to run its complex simulations and analyses. Some of the resulting solutions include:

- First-in-class design of specialized self-elevating boats that lift themselves completely out of the water. MiNO designed the world's largest cylindrical lift boat, with legs that extend 335 feet.
- Design and optimization of a new class of offshore wind turbine installation ship leveraging MiNO's experience with participation in the first U.S. implementation of an offshore wind farm.
- Rapid penetration into the mature, inland towboat market, designing a 6,000-horsepower towboat with a unique allnew hull design that instantly became a sales differentiator multiple ships in production in under a year.





BENEFITS

JARVICE and the Nimbix Cloud now allow MiNO to perform simulations and analyses that used to take days in a few hours. The company's workstations would often run full-throttle for days at a time, even those equipped with eight cores. "Depending on its complexity, we could let a Star-CCM+ simulation run for several days, but Nimbix cuts the time down to mere hours," says Bourg. "The only other option to get the run times down was to invest in our own cluster, and then we'd be faced with the cost and burden of operating and maintaining that system."

In addition, unlike desktop workstations, Nimbix allows MiNO to run simulations in parallel, giving them greater bandwidth to complete their clients' design analyses in a fraction of the time and at a lower cost. "We pay Nimbix for the processor time, plus clock time on our Star-CCM+ licenses," says Bourg. "We can upload dozens of these scenarios and run them simultaneously on hundreds of cores, letting us analyze a whole matrix of design cases in a day or two. That's a huge benefit for us in terms of schedule and a big plus for our clients."

"The speed, ease of use, and cost efficiencies we get from partnering with Nimbix, not to mention the incredible technical support they provide us, allow us to meet and beat our clients' deadlines and expectations," says Bourg. "It's been key to our making our mark on an otherwise mature engineering market in record time."



MiNO Marine uses JARVICE and the Nimbix Cloud to run the fluid dynamic simulations and analyses required to design vessels to withstand punishing water, wind, and waves.

COMPANY DESCRIPTION

MiNO Marine, LLC (MiNO) is a Louisiana-based naval architecture and marine professional services firm started by David M. Bourg in 1997. Staffed by a team of Naval Architects, Engineers, Marine Designers, and office support staff, MiNO's services range from marine vessel concept design to full vessel production drawing packages. The team has run Star-CCM+ fluid dynamics simulations and analyses in the Nimbix Cloud since 2017. This combination makes possible rapid analyses for resistance and powering, seakeeping, and many others, resulting in innovative, efficient, and stable design of various vessels and marine systems.