Orca3D and Simerics help propel the future of marine design with AMD processors

With a unique memory architecture and fast per-core performance, AMD Ryzen™ Threadripper™ PRO processors helps put a wider range of users at the helm of boat design.

AMD THREADRIPPER PRO

CUSTOMER

Orca3D

Simerics
TECHNOLOGY BY DESIGN

INDUSTRY

Marine design and analysis

CHALLENGES

Create an advanced marine design and analysis software package that is accessible to anyone with performance and price options to appeal to a non-specialist audience

SOLUTION

Leverage thread pinning scripting for fast access to the eight memory channels available in AMD Ryzen™ Threadripper™ PRO Processors to eliminate bottlenecks that would slow complex computations

RESULTS

Orca3D™ Marine CFD achieved a performance improvement of up to 63% on calculations when compared with comparably priced x86-based systems

AMD TECHNOLOGY AT A GLANCE

AMD Ryzen Threadripper PRO Processors

Twelve months ago, Andrew Adamson was navigating his catamaran through rough weather off his native New Zealand coast when he found himself thinking of ways to reduce his boat's engine noise and improve handling. Back on dry land, Adamson started working on sketches of alternate boat designs. However, Adamson doesn't claim to be a professional boat designer. He is best known as the director of Academy Award®-winning films, including Shrek and The Chronicles of Narnia.

To make his new electric-powered yacht a reality, Adamson needed to test how the boat design would perform. A computer enthusiast at heart, Adamson soon found himself on a journey that led to his taking advantage of AMD Ryzen™ Threadripper™ PRO 3975WX technology to bring the specialist's world of high-performance computer-driven computational fluid dynamics down to his desktop.

For most of naval history, testing boat designs involved building scale models and seeing how they behaved in towing tanks, a laborious and expensive process that could easily consume months. Andrew's research led him to Bruce Hays, partner at Orca3D, the makers of the Orca3D™ marine design software used to design the shape of hulls and perform stability analyses.

As Hays explains, "If you want to design a boat that's revolutionary as opposed to evolutionary, you need precise numbers. Testing scale models is expensive, time-consuming, and presents scaling issues, so these days, we increasingly use computational fluid dynamics (CFD) software."

Marine design meets fluid dynamics

Growing demand for CFD capability explains the productive partnership between Orca3D and Simerics, developers of the leading analyst CFD platform called Simerics-MP®.

"AMD Threadripper Pro gave us an immediate 23% performance improvement over comparably-priced x86 processors."

Bruce Hays, partner, Orca3D, LLC

Together, the companies developed a solution called Orca3D™ Marine CFD. Rich Moore, Executive Vice President for Simerics Inc., says, "Traditionally, CFD has been the realm of specialists. But, we've created a system that people who aren't CFD specialists with PhDs can use reliably."

The software suite consists of three components. Rhino® is a software package for general purpose 3D modeling. Orca3D is a plug-in that adds marine-specific design and analysis tools to Rhino. Simerics-MP CFD with a marine template provides the CFD simulation capability.

Specialists typically use clusters of high-performance computers or cloud computing. But those are too costly and impractical for customers like Adamson who need something they can run on their desktop. Moore says, "Creating a software package that any designer, naval architect, or passionate consumer can use required coming up with a solution that is easy, reliable, and importantly, fast."

Breaking with tradition

CFD workloads require a CPU that can handle impressive computational tasks. Early in 2021, the Orca3D-Simerics development team began testing AMD Ryzen Threadripper PRO processors. Hays says, "AMD Ryzen Threadripper PRO gave us an immediate 23% performance improvement over comparably-priced x86 processors." But it turned out the team had only scratched the surface, and Adamson's project provided the impetus for digging deeper.

Adamson's design is not the traditional boat you'd encounter at your local marina. His unique hull design is optimized to dramatically reduce the boat's reaction to waves, making it very stable. The challenge is that such a design could be inefficient at cruising speed, the opposite of what is required for a craft with electric propulsion.

AMD

To resolve the problem, Adamson designed foils that lift the twin hulls out of the water, reducing resistance. Much like an airplane, control surfaces are then needed to "fly" the boat. Modeling these control surfaces is a complex computation problem because the geometry and sea conditions constantly change.

Unlocking hidden potential with AMD Ryzen Threadripper PRO

"Having the capacity to turn around iterations quickly became important. I had a lot of ideas, and every innovation was an experiment," Adamson explains. Thus began the software team's quest for more speed and efficiency. Using a Threadripper PRO 3975WX with 32 cores and 64 threads, Andrew's system offered the performance needed. When even higher performance is needed, Threadripper PRO 3000WX series CPUs are available with up to 64 cores and 128 threads.

Hays explains, "We discovered that the eight memory channels available on the Threadripper PRO platform would give us a huge advantage over dual- or quad-memory channel CPUs. You can have all the cores in the world, but if computations have to wait for memory, everything slows down."

The AMD Ryzen Threadripper PRO platform is designed around "chiplets," with a chiplet being a set of eight cores with dedicated L3 cache and fast access to the eight memory channels. If Windows is allowed to allocate processes, they tend to migrate among chiplets. Using AMD's recommended thread pinning approach, developers can instead optimize process allocations to ensure effective use of cache and the fastest access to the memory. Working with the AMD software performance team, Orca3D and Simerics optimized scripting and BIOS options to achieve a further performance improvement of up to 63%. Moore says, "Let's just say that the resulting combination of AMD Threadripper PRO and Orca3D Marine CFD is measurably faster than anything else on the market."

"The thread pinning script in our software, developed with the help of AMD, gives us flexibility and scalability to support a wide range of customers and help them strike the right balance between run time and cost."

Rich Moore, Executive Vice President, Simerics Inc

Providing customers with flexibility

"The range of options from 16 to 64 cores offered by the Threadripper PRO family is important because customers have different budgets and needs. He continues, "The thread pinning script in our software, developed with the help of AMD, gives us flexibility and scalability to support a wide range of customers and help them strike the right balance between run time and cost."

Adamson's 32-core system helped him achieve an almost effortless, creative routine. "Every day, I would get a simulation running. By morning, I could see what needed improving and then start the process again. I got a lot further than anyone has the right to without having a doctorate! The system's speed enabled that iterative learning process, as well as the natural iteration of the design process."

Smooth sailing into the future

Moore concludes, "The AMD software performance team's guidance helped us to get the right set of parameters into Orca3D Marine CFD. That made the difference between a one-off solution to help Andrew with his project and a product that any user can use on their own Threadripper PRO CPU-based system. Soon we'll be able to use scripting to automatically detect a customer's particular Threadripper PRO configuration and optimize our software to deliver the best experience for their system."

Adamson hopes to begin construction of his dream vessel later in 2022. He is also working with another Orca3D user, the award-winning naval architecture firm LOMOcean, to refine his design and further develop it for commercial applications. Adamson's hope is that his design will help reduce use of fossil fuels on the world's oceans.

Andrew Adamson
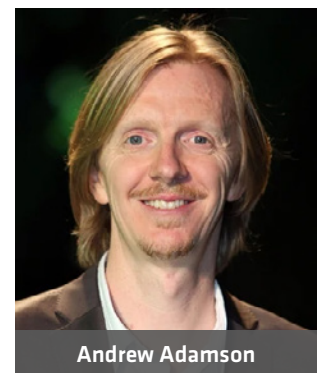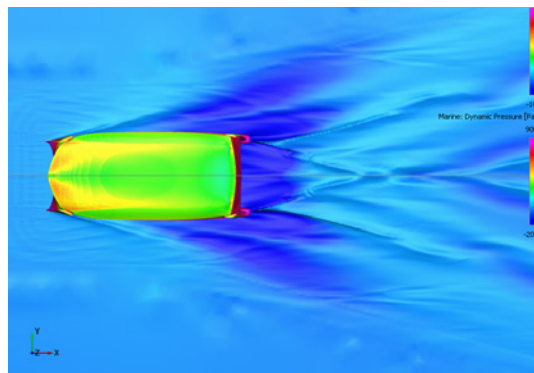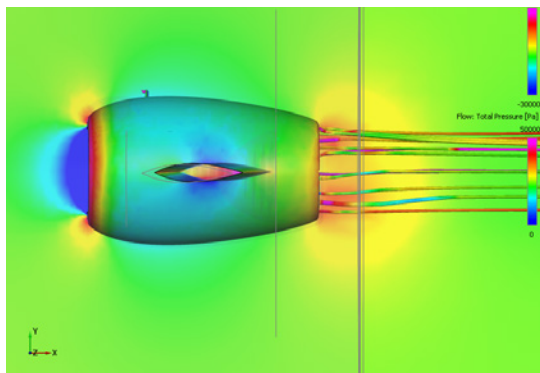
About Orca3D
Orca3D, LLC is the leading developer of marine design software tools for the Rhino® environment, with thousands of users worldwide in the recreational, naval, and commercial marine markets. A broad range of customers, including shipyards, design firms, government agencies, and educational institutions count on Orca3D for fast, accurate, and easy-to-use solutions, coupled with timely and thorough technical support. For more than 30 years our team of naval architects has been providing commercial-off-the-shelf software, custom software solutions, and consulting services to the marine industry around the world. For more information, visit orca3d.com.

About Simerics
Simerics is headquartered in Bellevue, WA and are the developers of Simerics-MP; Simerics-MP+; Orca3D Marine CFD; Creo Flow Analysis; Simerics MP for Fusion; Rhino Flow-RT; CFTurbo SMP all leading simulation products. Simerics and our partners serve several vertical industries: Marine, Auto, Aerospace, Pumps, Valves, Compressors, Heat Exchangers, Electronics and eMotors, Turbine, Oil and Gas and general CFD problems. For more information please contact rich.moore@simerics.com or visit www.simerics.com.

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