

## 'Out-of-the-box' naval architect is making waves

by Bruce V. Bigelow

Sometimes a career can swerve in unexpected directions.

When Bill Burns was studying mechanical engineering at the University of California San Diego, he never expected to go into naval architecture or specialize in developing innovative hull designs.

But what began in 1990 as an "interim" job with Alberto Calderon, a San Diego physicist, led Burns to the 21st floor of the First National Bank Building and a sweeping view of San Diego Bay.

MARITIME ENGINEERING - M Ship Co. co-founder and Executive Director Bill Burns on a glassy San Diego Bay. In the background is Stiletto, the prototype military warship that Burns helped develop. CNS Photo by Howard Lipin.

UNORTHODOX DESIGN - The bottom of the boat has tunnels that channel the bow wave, generating both hydrodynamic and aerodynamic lift. CNS Photo by Howard Lipin.

It is the office of M Ship Co. and CBTF Co., two closely related maritime engineering firms that pioneered unorthodox designs in their respective fields of naval engineering.

M Ship Co.'s breakthrough lies below the waterline, where its hull design has tunnels that channel the bow wave in a way that generates lifting pressure, which enables a powerboat to move faster.

CBTF pioneered a similar advance in sailboat design by replacing the conventional fixed keel with movable ballast and a more agile fore-and-aft rudder design.

With the same core group of principals at both firms, CBTF and M Ship Co. operate like some studio rock bands that hire specialized session musicians to play key parts in special projects.

"Working with Bill is always a collaboration," said Douglas D. Holthaus, a San Diego maritime lawyer who has worked with Burns for years. "He doesn't give orders. He deals with everything in a nonconfrontational fashion. Yet, he's always been involved in these out-of-the-box type ideas."

Out of the box was also the phrase that San Diego naval architect Doug Peterson used to describe Burns, 43.

"That's mainly what he's known for," said Peterson, a renowned designer of America's Cup racing sloops who has worked with Burns as a consultant. The list of other top naval architects who worked with Burns include America's Cup designer Bruce Nelson, John Reichel and Jim Pugh.

At CBTF and M Ship Co., Burns has worked closely with Charles W. "Chuck" Robinson, an unusually versatile entrepreneur who made a fortune in mining and shipping before serving as a deputy secretary of state in the Ford administration.

Robinson, who later worked on Wall Street and in New Mexico energy and real estate development, said he put up all the money for CBTF, which was founded in 1988 as DynaYacht, and for M Ship Co., which he formed in 1998.

"Bill is very valuable and absolutely essential," said Robinson, the chief executive of both firms. "His experience is in developing designs and supervising construction, and in the engineering end."

Neither firm has shown a profit, but Robinson said that M Ship Co. represents "a better opportunity to make a profit." Under Pentagon contracts, M Ship Co. developed an innovative hull design, which has potential for use in markets for commercial and recreational powerboats as well as military applications.

The firm's hallmark "M-hull" name was derived from a cross-section view of their innovative hull design. The center of the M is the boat's central displacement section. Running alongside on each side are tunnels that extend from the bow to the stern. Air churned from the bow wave is forced through the tunnels under increasing pressure, which generates a cushion of air against the hull bottom that acts like that on an air hockey table.

M Ship Co. secured \$6 million to build an 88-foot coastal warship prototype through Robinson's personal contacts in the government.

Called Stiletto, the boat built at the Knight & Carver boatyard in National City, Calif., was outfitted with an additional \$6.5 million in electronics and other equipment and ranks as the largest U.S. warship made entirely of advanced carbon composites.

A key innovation that Burns spearheaded was adapting "a virtual shipyard" approach to construction of the Stiletto, Robinson said. By using computer-based 3-D modeling and outsourcing various tasks to different boatyards, Burns said construction of the all-composite vessel took less than a year instead of the 18 to 24 months required for similar boats.

Yet Robinson, 87, says M Ship Co. needs to secure its future by finding a big partner with the necessary capital, management experience and government contacts to build the business.

While M Ship Co. has only 12 employees, Burns said, "What we offer is a culture - almost like a Skunk Works - for a larger company."

Burns grew up in Newport, R.I., the oldest of six children in a house where they could watch the America's Cup races. He said he enjoyed unusual freedom, spending much of his time on the water with friends and brothers.

"We'd leave in the morning and be gone all day," he recalled.

Burns attended a private high school, where he was on the sailing team, and he was good at science and design.

"I didn't think I could make much of a living in design," Burns said. "So I went to engineering school," which is how he arrived in San Diego.

Burns said he expected to leave San Diego after graduating from UCSD, but he began working for Calderon, an expert in fluid dynamics who is credited with developing the fore-and-aft rudder concept for USA, the late Tom Blackaller's 12-meter yacht, during the 1986-87 America's Cup.

"I thought I'll do it for a couple of years, and then I'll get a real job," Burns said. "I thought I was taking a risky path forward, but it turned out to be a lot more solid than it was for classmates in mechanical engineering who went to work in the automotive industry."

At the time, Calderon was working with Robinson on an idea that combined the agility of the thin hydrofoils used in his fore-and-aft rudder design with a "canting ballast." The canting ballast replaced the heavy fixed keel used on conventional sailboats with a weighted bulb mounted at the end of a thin fin. The fin can be tilted, or canted, from one side of the sailboat's bottom to the other.

Because the ballast can be shifted from side to side, it only has to weigh about half as much as the keel

needed by a comparable conventional sailboat for the "righting moment." The term refers to the angular force, or torque, that opposes the force of the wind and keeps a heeling sailboat from simply blowing over.

The idea of a "canting ballast twin foil," or CBTF, represented a radical leap in offshore racing design, which was developed by Calderon, Robinson, Burns, Matthew B. Brown and Peter Isler. The technology also led Robinson to start the firm now known as CBTF, which operates mostly as a licensor of CBTF technology.

Reducing the weight can dramatically improve the performance of sailboats used in offshore racing, although it has taken nearly 15 years for the sailing community's rule makers to permit CBTF designs.

"We were able to take the equivalent weight of a small car out of the boat," Burns said.

Two of the three top finishers of the 2006 Rolex Sydney Hobart Yacht Race were CBTF designs. The winner, Wild Oats XI, was created by Reichel-Pugh, a naval architecture firm that has licensed the technology.

"Reichel-Pugh has refined the design further and worked with CBTF longer than anyone else," Burns said.

For Burns, the process that led to the culmination of the CBTF design became as important as the design itself.

He vividly remembers how the team mounted different foils on the hood of a copper-colored Malibu station wagon and conducted self-styled wind tunnel tests by driving up and down the beach.

"It was that observation and field experimentation that allowed us to see new things and move to new ideas more quickly," Burns recalled.

At M Ship Co., he has adopted such guerrilla testing methods instead of more elaborate laboratory tests that require long water tanks or wind tunnels and can be much more costly and time-consuming.

Development of the M hull began after city officials in Venice, Italy, asked Robinson if he could help solve a problem afflicting the historic city of canals. The wake from powerboats plying local waterways was eroding the foundations of the historic buildings.

Robinson, who maintains a residence in Venice, asked Burns to join him in the development of a mangia onda, or "wave eater."

While the M hull design was originally created to reduce boat wakes, Burns said his team found the hull also was remarkably stable and efficient at high speed. They soon developed water taxis, ferries and a recreation sport fishing boat utilizing the design.

A crucial breakthrough came in 2003, when Robinson secured support for a military prototype from the late Vice Adm. Arthur K. Cebrowski, who was head of the Pentagon's Office of Force Transformation.

"The Navy looked at our design and said it wouldn't work," Burns recalled. "But the Office of Force Transformation was willing to take a risk with us."

To demonstrate the validity of their design, Burns said team members used a pontoon party boat to tow various M hull designs through San Diego waters. One argument raised against such crude field tests is that the measurements are not as good as data produced by tank testing. But Burns says such testing enabled the team to discover unexpected gains in performance that could not have been predicted by computer-based modeling.

"It's that observation and experimentation where you really find the breakthroughs," Burns said. "If it's just based on science or computer modeling, you can miss out on all these opportunities."

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