



Apr. 26, 2004. 06:24 AM – **Toronto Star**, page D1

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Master boatbuilder and designer Ian Taylor with his revolutionary three-hull vessel design. It was built for strength and speed using composite-materials technology.

A Great Lakes prophet

Boat designer Ian Taylor has a ship-shape answer to transportation woes

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SPECIAL TO THE STAR

When the Toronto-Rochester fast ferry, *The Breeze*, sticks its long-awaited bow into Toronto Harbour sometime soon, it will be an occasion for celebration for boat designer Ian Taylor. Although he has no connection with the project, Taylor has good reasons to cheer.

"First, as a large, twin-hulled catamaran, it's something new on the Great Lakes," says Taylor, president of Burlington-based Reflex Advanced Marine Corp. "I say 'new,' but it really has the advantage of being a mature design proved around the world in commercial service, yet absent from the Lakes.

"Second, it's a tentative return to the use of Lake Ontario for transportation. It's tragic we don't appreciate and use the lake as more than just a marvellous natural resource. There are days when you can be stuck in traffic on the QEW, you look out over this calm body of water and there isn't a single commercial vessel to be seen.

"This is a hideous waste of a tremendous transportation resource and, in other parts of the world, would be used for more than just leisure."

Those reasons for Taylor's delight may seem heart-warmingly altruistic in these all-too-jaded times. But he is the first to admit a prime reason for his joy is *The Breeze* may open the floodgates on a project he has nurtured for 15 years. A project — and a vision — he admits had seemed in danger of foundering in the choppy waters that challenge all inventors just slightly ahead of their time. A Canadian-based project that, Taylor hopes, will change the face of boat design, construction and operation not just on the Great Lakes, but on the two-thirds of the globe covered by water.

Taylor is the designer of both the Reflex hull — a multi-purpose, triple-hull catamaran design — and a complementary production concept that takes his design one step further through the use of advanced composite materials. This revolutionary hull produces a shallow-draft vessel faster, more stable and more fuel-efficient than conventional V-shaped hulls or even twin-hulled catamarans, such as *The Breeze*.

"The use of composites and the tooling is not absolutely necessary," says Taylor, emphasizing the nimbleness of the design itself. "It can be done with aluminum. But the composite materials do take the design even further by virtue of lightness, toughness and ease of production. It is vital when it's applied to security, pursuit and stealth craft, which have to go undetected by radar, and which is difficult with aluminum and other metallic materials."

One virtue of Taylor's approach is he developed the Reflex hull not just as a design for modification to production needs, but as a design ready for immediate production to meet a wide range of real and anticipated needs.

The Reflex design has been conceived for use in everything from 9-metre search and rescue craft to 36-metre, 80-km/h fast ferries. The impending arrival of The Breeze has, says Taylor, fired him up on the prospects for the water taxi and ferry design elements of his project. Given financial and political support, he says it is capable of bringing a new dimension to passenger transportation on the Great Lakes. That's something he'd like to see happen not just for the sake of his own business, but because it makes sense in resolving many current transportation problems.

"This is a situation that has always seemed just crazy to me, too," says former federal Minister of Transport David Collenette. "The Great Lakes region is becoming so populated — particularly around Lake Ontario — and we've failed to use the lakes while our other transportation facilities are becoming increasingly overloaded.

"Innovation is certainly to be encouraged in this area, especially since we really do seem to have been asleep at the switch here. I've often wondered why private entrepreneurs haven't seized this opportunity yet, as they have in so many other countries."

For a working model, Collenette points to New York City. Here, he says, conventional commuter ferries crisscrossing the Hudson River were discontinued by the late 1960s, but a fast catamaran fleet revived the service to great fanfare and success in the 1980s. Although this has occurred in other U.S. cities such as Boston, San Francisco and Los Angeles, he is perplexed as to why it hasn't happened on Canada's inland lakes and waterways.

Says Collenette, "Vancouver is certainly a Canadian model that demonstrates how it could work. The water taxis and Sea Bus ferries there are longtime and integral components of the regional transportation system."

Taylor says views such as Collenette's reinforce his own belief there's a need and a market for better, faster and more fuel-efficient boat designs.



Side view of Reflex Advanced Marine's concept for a 33-metre passenger ferry built on the triple hull.

He says contemplating ways to caulk the leaks in our interurban transportation system has played a part in his 15-year dedication to his design and he hasn't been shaken in his belief that his isn't an impractical dream that will simply be cast adrift. He believes the Reflex hull and composite fabrication materials and techniques can help launch new marine services in markets such as these, which may not initially generate the revenue to justify the construction of more expensive, traditional boat designs.

While many designers steadfastly guard the details of their designs and refuse to display those underwater areas of the hulls that give them their alleged edge in speed, displacement, stability and fuel efficiency, Taylor is an exception. He eagerly shows off his test model, engineering drawings and calculations. He spritzes ideas like seltzer water and, if he can't explain a concept with words, he sketches it. Taylor has good reason to not worry about openly displaying the product of his passion.

"We received a notice of allowance from the U.S. Patent and Trademark Office earlier this year," he says, beaming like a proud father over the accomplishments of his children. "As well, we've secured the world rights and the Canadian patent is due any day. With those, we can move out of this lengthy research and development phase and into the market."

"Lengthy" seems inadequate to describe the voyage Taylor, his family and his investors have taken to get this far. He says it stems from his lifelong curiosity and a constant desire to take something good and better it. He sees himself more as an innovator than a creator, taking designs that have been discarded for various reasons, asking why they didn't click and how they could be perfected now.

Says Taylor, "There's nothing really new about multi-hull designs. I found material on the triple-hull concept going back to the 19th century. But previous designs had a middle hull that was deeper than the two outer ones. Myself and others who've worked with me discovered

that was the problem. The shallow middle hull in the Reflex design turns the old concept inside out."

Like any other hull, the Reflex design is focused on piercing the water as cleanly as possible and minimizing the vessel's surface contact. In this, the twin-hulled catamaran is a major advance over the traditional V-hull.

The Reflex design goes further. Its three thin bows slice into the water with reduced displacement and channel water back through the two tunnels between the hulls. The shallow middle hull has the advantages of giving the boat stability and manoeuvrability in rough seas or when cornering, but rising out of the water when the boat planes at high speeds. This reduces contact between the hull and the water surface, decreases the drag and, consequently, the required propulsion horsepower.

"That's always been the quest," says Taylor. "You want a hull to slice the water with minimum displacement and requiring the least energy. There's nothing new in that objective."

Whether the concept is old or revolutionary, Taylor should know. He has spent 39 of his 55 years in, on and around boats. Born in the English port city of Southampton, Taylor's connections with boats were slight in his early youth, even though his grandfather had been a ship's engineer and the numerous ferries that cross his hometown's harbour and the Solent to the Isle of Wight were entrenched parts of life there. What he yearned for was a career similar to his dad's in aircraft manufacturing.

Instead, at 16, Taylor won a competition for an apprenticeship in the luxury yacht building yard of Camper and Nicholson. It didn't take long for a love of the sea and ships to emerge, he says. Taught by the seasoned builders in the yard and simultaneously taking courses at Southampton College of Technology, the Shipbuilding Training College and Bristol University, Taylor was exposed to all manner of marine design, construction and materials as he worked toward his shipyard joiner and master boat builder certificates.

Taylor says, "They used everything in that yard and they were masters of all of them: teak, oak, steel, aluminum and fibreglass. It was great training to work and learn from these fellows who had 30 or more years of experience. I think one of my advantages at that age was, although I appreciated the older, traditional designs and materials, I wasn't wedded to them. Advancing the art of boat building interested me greatly."

From Southampton, Taylor went to Greece to manage a marine manufacturing company and discovered something about himself: R&D motivates him, but mass production bores him. He says once he set up a production line and turned out the first boats, his interest flagged. He knew his future was in design leading to production, not the day-to-day grind of the factory.

Back in England a year later, Taylor watched in horror as the government's 25 per cent Value Added Tax destroyed the market for luxury goods and brought down four-fifths of the British yacht building industry. Newly married, he gladly accepted an invitation to join the design team of an eccentric Massachusetts yacht designer in 1980. No sooner had he and his wife,

Josephine, made the move, than he was courted by Niagara-based C&C Yachts. The Taylors moved north in 1982, where he became a yacht designer and research manager for the Canadian firm.

It was at this stage that the triple-hull concept first seriously occupied Taylor's thoughts. It was by chance.

"A fellow in a yard across the way from us was trying to develop something along these lines and he had run into some trouble," recalls Taylor. "I'd played around with the concept myself and I offered to look at his designs. I eventually suggested we team up on the idea. But it had already beaten him down and he had just had enough of it. I took it from there, little knowing what I was getting into."

When C&C went into receivership, Taylor became a consultant and, because that work ebbed and flowed, he and his wife took on other jobs to keep going. He continued to work on what he and his family eventually referred to simply as "that boat project," typically said with eyes rolled upward and realizing nothing was going to set him off course.

A conversation with Taylor is overwhelming, taking you swiftly in so many directions you need to decompress afterward

One of Taylor's consulting clients was DuPont Canada, then attempting to find markets for its high-strength fibre, Kevlar.

"It's a wonderful material," says Taylor. "Imagine it as a series of tiny plastic rods woven together. Its great strength is its resistance to tension. It's about six times stronger than steel of the same weight and 40 per cent lighter than fibreglass."

Fibreglass — which Taylor says is best visualized as a multitude of microscopic glass rods — is less expensive than Kevlar and resistant to compression. Blending the two materials brings out the best of each, the trick being to find the correct balance to produce a hybrid that is ideal in terms of strength, weight and cost.

"When we hit the right combination, we wound up with an extremely strong and flexible material that could be applied to many products," says Taylor. "I've worked with it to produce not just hulls, but also armoured vehicles, goalie masks and aircraft parts."

When Taylor and the DuPont hybrid fabric team combined this composite material with the triple-hull designs he had been evolving, the project started to jell. A vessel was built and tested against a V-hulled craft of the same size and horsepower. The test hull outperformed its competitor in most areas, even when it was overloaded to match the other design's higher

weight. Taylor says the tests also revealed some flaws, requiring further work. And more money.

Like a 1940s Hollywood cliffhanger, the story of Taylor's determination to perfect his Reflex hull is riddled with fortuitous situations that have saved the day and enabled him to cruise along toward introduction. He says his greatest champion has been his wife, Josephine, who not only worked a wide variety of jobs to help keep the family and the project going in lean times, but also took on mind-numbing tasks associated with the creation of the Reflex hull drawings and documentation.

Taylor's other stabilizers have been partners, Hamilton maritime lawyer and vice-president of legal affairs, John Findlay, and financial manager Mike Luscombe, the firm's vice-president. An avid recreational sailor, Findlay came on the scene in the mid-1980s, when he represented former C&C Yachts employees in the receivership proceedings.

"I was immediately impressed by Ian's enthusiasm and his vision," says Findlay. "His theories were very lucid and I could see this concept was a real passion for him, yet he was completely realistic. He didn't want to just develop the concept, he wanted to apply it."

When Taylor needed money to conduct further tank tests on his model hull, fate once again took a hand and brought Luscombe on deck: "I went to cash in some RSPs to fund the tests and Mike was the financial advisor who had inherited my file. He asked me why I was doing it, wanted to know more about the project and eventually became a partner."

Another 44 investors have since signed on and Taylor breaks out into one of his frequent grins when he says the company, which was incorporated in 1993, "owes not a single cent to a single bank. Even though we have several times cocooned the company while we raised more funds and worked on other projects to sustain this one, we've kept going and made it to the point of having the patents, the moulds, the tank test models and a full-size vessel."

That 13-metre prototype is now sitting in the Newfoundland boat yard of Taylor's longtime supporters, Wally and Cathy Roberts, of Seacraft Ltd. It won't receive engines or interior fittings until it has a buyer. A board in Taylor's Burlington office lists more than a dozen potential contracts, with varied specifications.

A conversation with Taylor is an overwhelming experience that can take you swiftly in so many directions you need time to decompress afterward. He knows this himself and, to place his brainchild in an understandable perspective, Taylor heels back to the idea of fast water taxis and ferries on Lake Ontario.

Taylor points out that the Great Lakes were once a hotbed of boat design and were used extensively for commercial transportation. But passenger service vanished and the marine freight trade seems to be on a taut lifeline today. The reasons for the scuttling of the passenger business are many, but the prime ones were automobiles and government-funded highways.

As the marine passenger market sank after World War II, operators couldn't justify the cost of new vessels to replace older, inefficient fleets. And so ended the tradition of sailing on fabled lake boats such as the Cayuga and S.S. Kingston, which connected downtown Toronto with Port Dalhousie, Rochester and other Lake Ontario ports.

"But under the right circumstances, water transportation should be inherently more cost effective than road or even rail. The largest piece of infrastructure is the water — and it's free," says Taylor.

Taylor believes the Reflex design can cut many costs.

"You don't need deepwater harbours because the Reflex hull is shallow draft. That eliminates the cost of constantly dredging harbours when they silt up.

``These shallow draft ports could be kept ice-free merely through `bubbling' ... not with expensive ice breaking. From an environmental point of view, these vessels work well because they create little wake and you're not contributing to shore erosion."

Taylor's 80 km/h ferries and water taxis would be passenger-only with capacities ranging from 50 to 250 travellers. By comparison, The Breeze is a 720-passenger ferry designed for combined passenger/automobile/truck service. That, he says, calls for more extensive port facilities: "I'm not knocking that type of service — it's quite valid — but there is also a market for a pure passenger service, too, which would require minimal harbour facilities."

Taylor proposes a kind of express commuter train on water, with the same low-cost stations and parking facilities as GO Transit. He says it wouldn't replace rail and bus service, but augment it. With reduced infrastructure costs, he foresees being able to establish routes from lakeside points. The vessels could serve attractions such as hotels, casinos and recreation areas in off-peak hours.

Taylor admits there are some obstacles that can't be fully overcome, such as the variables of weather. Yet this isn't unique to water transportation.

"When the weather closed the highways or froze the railways' switches and signals this winter, no one suggested these modes should be chucked out," says Taylor. "You make allowances for those conditions. And, yes, there would be some days when the weather would mean cancellation of the service and substitution of buses. But that would be minimal."

Taylor points out the safety aspects of his plan. He says composites produce a vessel tougher and more resistant to damage from ice or submerged objects. In an impact test, a spike went through 3/16" aluminum, but bounced off the same thickness of the Reflex's composite material.

"Boat building is no different than any other field when it comes to resistance to new designs and materials," Taylor adds. ``It was difficult to gain acceptance for the use of iron and then

steel instead of wood in hulls in the 19th century. It was just as difficult to get aluminum and then fibreglass accepted in the 20th century."

Taylor sounds eerily like one of those transportation innovators of old, who embraced new designs in the face of reluctant builders and buyers, but stuck to their beliefs long enough to be called visionaries.

The steel hull, steam turbine, diesel locomotive and jet aircraft are examples of transportation innovations that pushed their creators through stormy seas before they found the safe harbour of acceptance.

Taylor has enough maritime history in his blood to know those stories. And he says he knows what always does the trick: "It's timing. You never want to be too far ahead. You want to ride the leading edge of the wave. I'm convinced the Reflex hull's time is just about here."