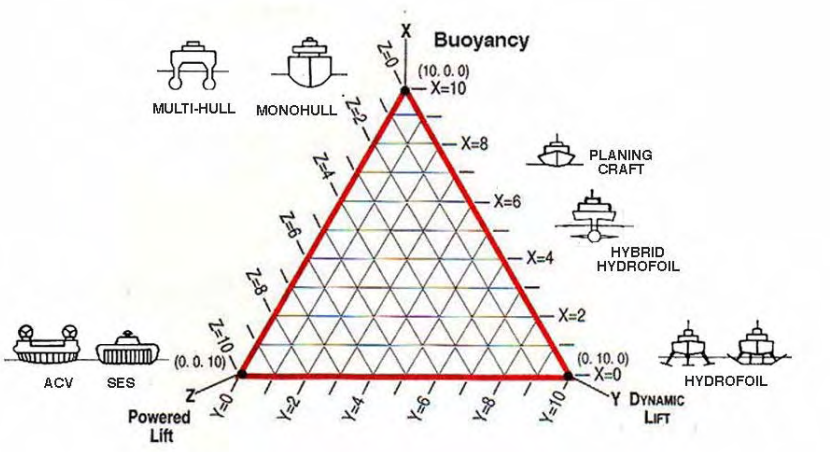
AliSwath and HYSWAS Technology
By John R. Meyer, Consultant, High Performance Marine Vehicles

I wish to compliment Rodriquez Cantieri Navali for their ambitious project described in the October 2006 issue of Fast Ferry International, in the article "Rodriquez AliSwath to be launched in 2007." I am extremely pleased to see that Rodriquez is developing a Hybrid Hydrofoil hullform prototype, and am sure it will be very successful.

This is a giant step for this hybrid hullform from the earlier Hydrofoil Small Waterplane Area Ship (HYSWAS) demonstrator vehicles developed and tested in the U.S. and Japan in the early 1990s. One of these, QUEST, was designed, built and tested for the US Navy by Maritime Applied Physics Corporation (MAPC). Another was HYATE, by Kawasaki, who demonstrated HYSWAS technology in connection with the Japanese Techno-Superliner (TSL) project.

I will describe here a short history covering some of the events that led to HYSWAS demonstration vehicles in the 1990s and now the AliSwath.

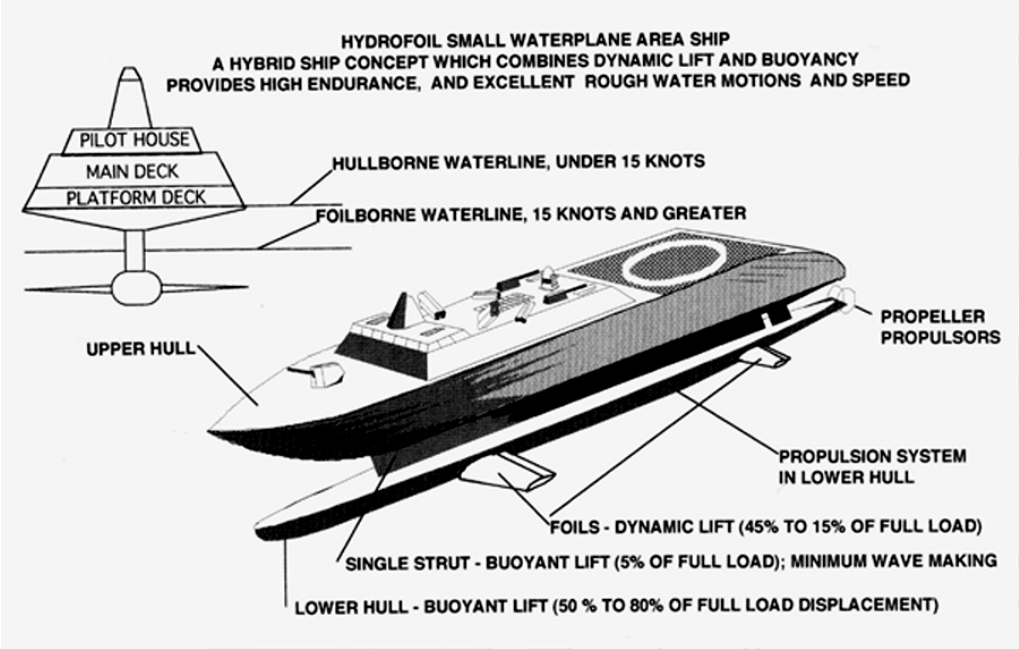
For more than 25 years, beginning in the early 1970s, researchers at the U.S. Navy's David Taylor Research Center (DTRC) studied a wide variety of hybrid hullforms in what was designated the Hybrid Marine Interface Vehicles Program. Early in that process, they developed the familiar "sustention triangle" and conceived many marine vehicle concepts employing the three basic lift mechanisms in various ways.



Sustention Triangle

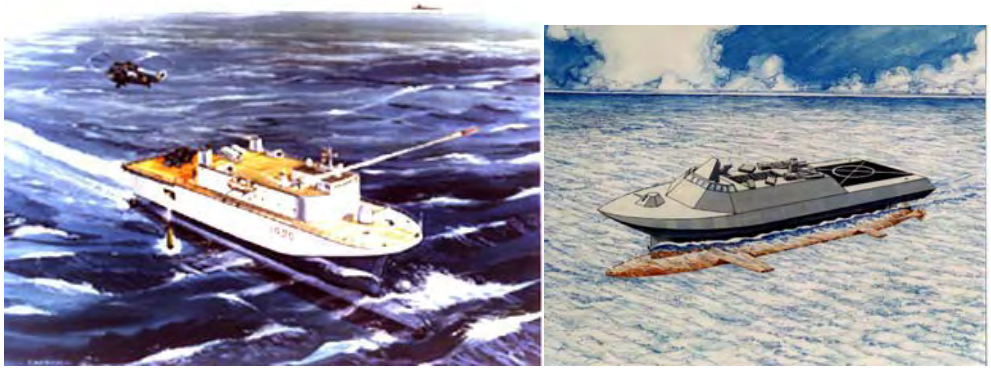
The HYSWAS concept was one of those considered most attractive, and several viable variants of it were generated. The one considered most promising derived its buoyancy from a single slender submerged hull, plus dynamic lift from a fully-submerged foil system. It was technically feasible and had potential to give considerable improvement over monohulls and conventional hydrofoils in terms of maximum speed, motions in rough water, and range at high speed.

The favored concept (shown in the illustration below) consisted of an upper hull having either a monohull or catamaran form, connected to the long submerged hull by a single slender strut. Dynamic lift from the foil system would raise the upper hull from the water surface at a speed of 15-18 knots, leaving only a very small waterplane area of the single strut at the water-air interface. A foil-based automatic control system would maintain a predetermined flying height and provide a stable platform in waves.



Besides lift, the forces generated by the HYSWAS foil surfaces are sufficient to counter roll, pitch and heave forces in high sea states. Propulsion can be provided by prime movers placed in the lower hull, directly driving propellers at the stern.

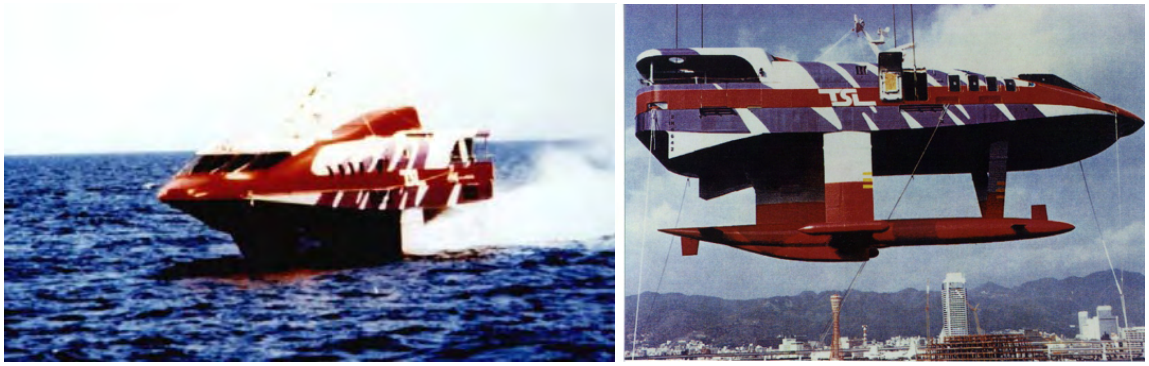
Many examples of military HYSWAS concepts were examined during the 1980s, including the two shown here. Since that time several feasibility designs using HYSWAS technology have been carried out.



In 1993 the Naval Surface Warfare Center, Carderock Division (previously DTRC) awarded a contract to Maritime Applied Physics Corporation (MAPC) to develop a HYSWAS demonstrator. The 27-foot, 12-ton, 35-knot craft called QUEST was designed

for three purposes: a) to demonstrate HYSWAS hullform technology, b) to study its use in unmanned missions, and c) to serve as a catalyst for commercial development of HYSWAS. QUEST, shown here, was delivered to the Navy in 1994 followed by initial trial in the Annapolis, MD area. Its stability and motions while flying were actively controlled by an automatic foil and rudder control system. Rough water trials, performed in 1996, demonstrated that QUEST's seakeeping performance was exceptional for its size.

In 1989 the Japanese Ministry of Transportation and the Technological Research Association of Techno-Superliner established a goal to develop ships to carry 1,000 tons of cargo a distance of 500 nautical miles at 50 knots in Sea State 6. One TSL concept developed was the TSL-F, a hybrid-type ship using a submerged lower hull with hydrofoils, connected to the upper hull by five struts. The TSL-F R&D was performed jointly by Kawasaki Heavy Industries, Ltd., Ishikawajima-Harima Heavy Industries Co., Ltd., NKK Corp., Hitachi Zosen Corp. and Sumitomo Heavy Industries, Ltd. Kawasaki built the demonstrator, HYATE, and delivered it in March, 1994. Capable of speeds of about 40 knots, its seakeeping was reported to be excellent.



Hybrid hydrofoil technology and application studies carried out over the past two decades have clearly dispelled the perception that foilborne vehicles have to have short range, carry relatively small payloads, be limited to sizes of only a few hundred tons, be complex and unreliable due to high-tech equipment, and be excessively costly.