WILSON SHIPYARD, INC.

WILMINGTON, DELAWARE

INTRODUCES

THE ALBATROSS

AMERICA'S FIRST OPERATIONAL HYDROFOIL

WILSON SHIPYARD, INC.
FOOT OF FOURTH STREET
WILMINGTON 99, DELAWARE
AREA CODE 302 OL 6-8221

THE WILSON HYDROFOIL *ALBATROSS*

FACT SHEET

Length	33′ 10″
Beam	11′ 4″
Foil Beam	15′ 2″
Draft Hull-Borne	6′ 6″
Draft Foil-Borne	2′ 6″
Displacement	6 Tons
Passenger Capacity	22
Crew	2
Engine	General Motors 6V-53 Diesel
Power	181 Shaft H.P.
Hull Design	"V" Step Hull
Hull Material	Welded Aluminum

Approved by U. S. Coast Guard for Passenger Service

SPEED

Fully foil-borne	18 m.p.h.
Cruising speed foil-borne	32 m.p.h.
Top speed foil-borne	40 m.p.h.
Distance to reach foil-borne speed	500′

ADVANTAGES OVER CONVENTIONAL DESIGN VESSELS

50% higher speed with same power.

Faster schedules in commercial service.

Lower operating cost per mile.

Smoother, more comfortable ride.

Greater stability in both smooth and rough seas.

THE WILSON HYDROFOIL *ALBATROSS*

America's first passenger hydrofoil vessel, the *Albatross*, is now being demonstrated on the East Coast by Wilson Shipyard, Inc., Wilmington, Delaware.

First of a series of hydrofoil vessels to be produced by the Wilmington shipbuilding firm, the Wilson *Albatross* carries 22 passengers at speeds up to 40 miles per hour. Its hull is entirely of aluminum and it has extruded aluminum foils. Power is furnished by a General Motors 6V-53 diesel engine.

Although hydrofoils are already in operation in Europe and Russia, the introduction of the Wilson *Albatross* marks the United States' official entry into the hydrofoil field on a production basis.

"The Wilson *Albatross* heralds a new age of water transportation which will dramatically change our present concepts of highway and railway communications," said Robert W. Dowling, president of City Investing Company of New York, owner of the Wilson Shipyard.

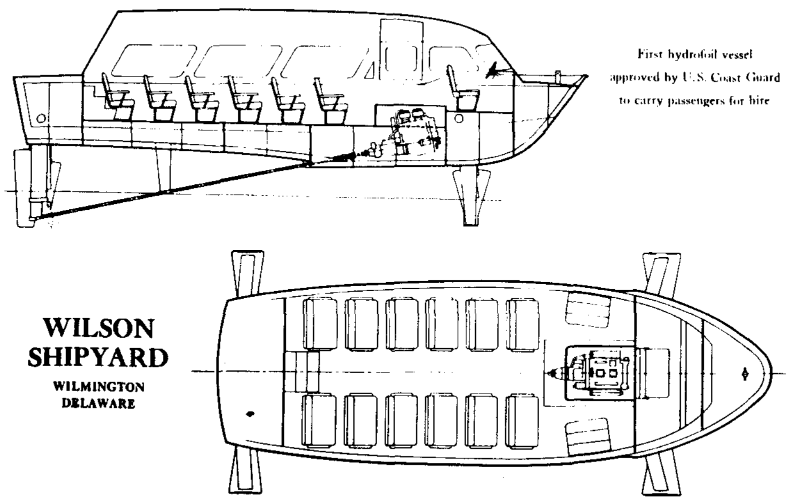
"Current highway construction programs are extremely costly, resulting in high taxes. No new railways are likely to be built. The only opportunity to improve our transportation system on an economic basis appears to be to return to the water routes first used in our country," Dowling said. "In the future wherever there are waterways the hydrofoil will provide commuters faster, less expensive and more comfortable transportation."

Unlike conventional boats a hydrofoil features foils that extend out from its hull. Like aircraft wings the foils develop lift from the forward motion of the craft, raising the hull completely above the water. When the vessel becomes "foil-borne" it is supported entirely by the foils, which eliminates water friction on the hull, resulting in greater speed at less power as well as smoother performance.

Wilson Shipyard began production of the first 25 hydrofoils in late 1962, according to Colonel Allan E. MacNicol, president of the shipbuilding firm. J. J. Henry Co., Inc., naval architects of New York and Philadelphia, have been engaged by Wilson as consultants.

Colonel MacNicol said that Wilson Shipyard has been preparing for hydrofoil construction for a number of years. "We have closely followed hydrofoil experiments conducted by the United States Maritime Administration and other agencies, and we have sent engineers abroad to study developments throughout Europe and Russia," he said. "We anticipate developing bigger and faster hydrofoils in the future at Wilson Shipyard based on our research in this field."

Passenger accommodations of the hydrofoil "Albatross"

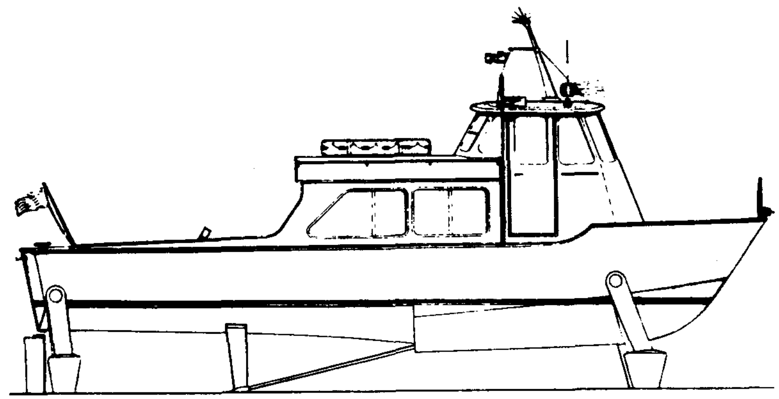


First hydrofoil vessel approved by U.S. Coast Guard to carry passengers for hire

WILSON SHIPYARD
WILMINGTON DELAWARE

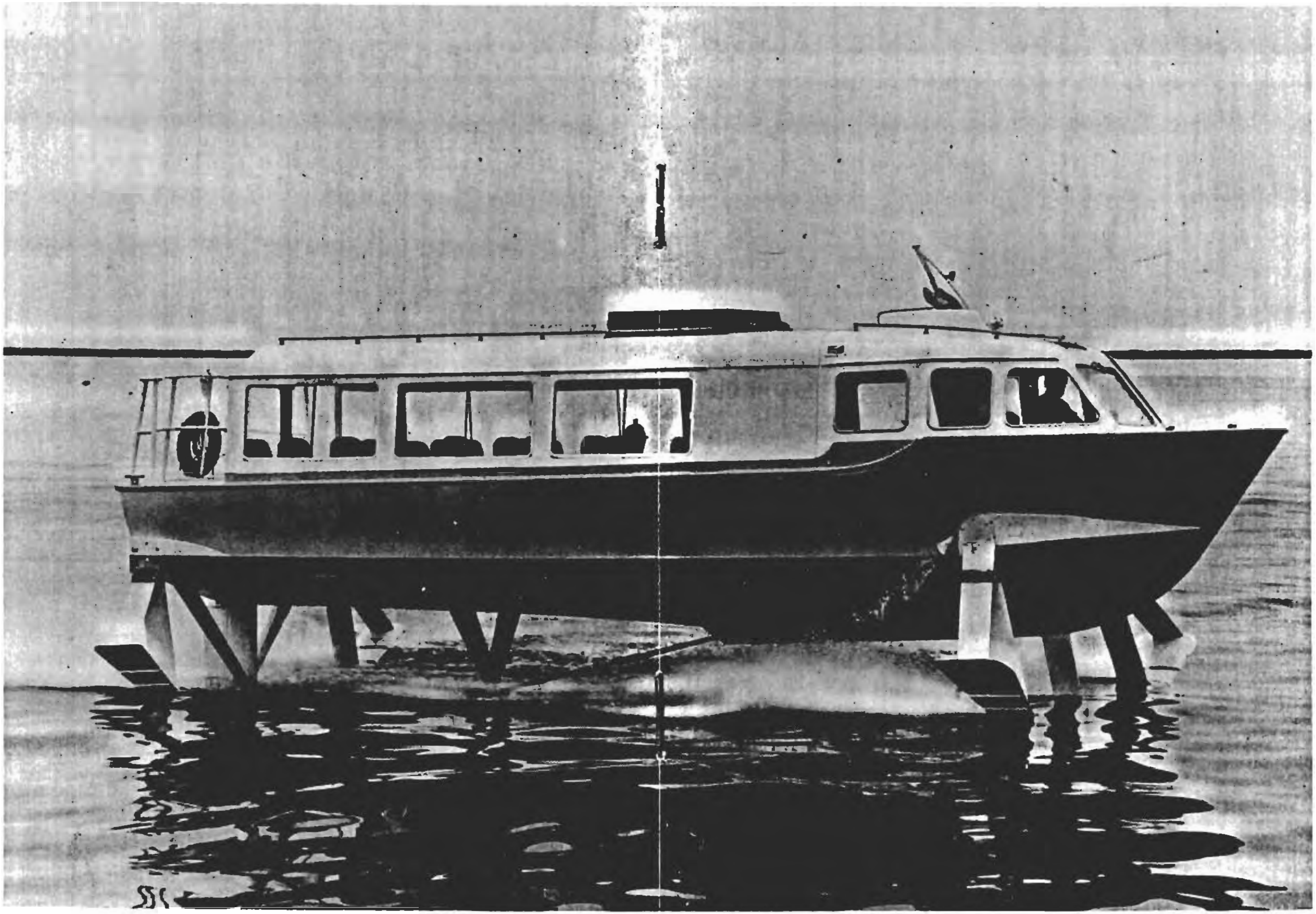
GM DIESEL ENGINE 6V-53

The GM Diesel model 6V-53 which powers the Wilson *Albatross* is a six-cylinder, "V" Series 53 engine manufactured by the Detroit Diesel Engine Division of General Motors. The engine develops 181 shaft horsepower at 2800 RPM and drives the craft through 1.5:1 reduction gears to a 20″ x 24″ propeller. Due to its two-cycle design the engine is extremely compact, has a very favorable low weight to horsepower ratio and fast acceleration. These are characteristics making it especially adaptable for hydrofoil operation. The engine was accepted for this type of craft after extensive tests off the West Coast where foil-borne speeds up to 40 MPH were attained with a full load of 24 persons aboard. The engine is one of three Series 53 Diesels developed by the Division for smaller pleasure craft and work-boats.



34-FOOT HYDROFOIL PATROL VESSEL

Wilson Shipyard, Inc., and its design agent, J. J. Henry Co., Inc., New York and Philadelphia, have developed outline specifications for 34-foot hydrofoil patrol vessels, based on the successfuly proved features of the *Albatross*. The patrol vessel concept should be particularly useful in military and naval applications, including anti-submarine warfare, air-sea rescue and amphibious landing operations, as well as for general law enforcement, marine fire-fighting and similar purposes. Hydrofoil vessels of similar size are already widely used in Europe as police launches, rescue boats, and coastal patrol vessels.



THE "ALBATROSS"

TECHNICAL BACKGROUND ON HYDROFOILS

Hydrofoil vessels differ from those of conventional design in having beneath the hull wings or foils which develop lift from their forward speed. After reaching a certain speed, the hull is lifted completely out of the water, and its weight is borne entirely on the foils. The hull is specially designed so that it will easily lift clear of the surface. Since drag of the hull is completely eliminated in the foil-borne condition, much higher speeds are possible at lower power consumption than in a conventional vessel.

The principle of operation is similar to that of an aircraft wing in air. Water flowing across the curved upper surface of the foil must travel a longer distance, reducing its pressure and creating a suction that pulls upward on the foil. At the same time, the pressure against the flat underside of the foil is increased slightly, depending on the angle of attack. The combination of suction and pressure produces a lifting force, raising the vessel and, after foil-borne speed is reached, lifting the hull entirely clear of the water.

There are two basic types of foils used on hydrofoil vessels — the surface-piercing type and the fully submerged type. The surface-piercing foil, observed bow-on, has a "U" or "V" shape. When the vessel is foil-borne, only the central part of the foil remains submerged; the ends are above the surface of the water. The fully submerged foil, seen from the same angle, is a horizontal plane, and remains entirely beneath the surface when the vessel is foil-borne.

The surface-piercing foil automatically compensates for changes in pitch attitude. Should the bow of the vessel begin to drop, a greater area of the foil will be submerged, providing added lift that will restore the vessel to the proper horizontal attitude.

With the fully submerged foil, some type of control system is necessary to maintain the attitude of the vessel. Mechanical sensing devices on out-riggers ahead of the vessel have been used, as well as autopilots which sense changes in attitude, inertia, or height of the bow above the water surface. Both systems then transmit corrective commands to control surfaces on the foil. Most operational hydrofoil vessels at present are of the surface-piercing type.

For all-weather ocean-going operation in the North Atlantic, where waves reach great heights, development efforts are being concentrated on vessels with fully submerged foils. At this writing (January, 1963) no vessels of this type have progressed beyond developmental testing. The major problem in developing hydrofoils for all-weather ocean service is providing a suitable system for maintaining stability when the hull is lifted high above the surface.

While the hydrofoil concept is not a new one, its development progressed slowly until recent years, when lightweight engines became generally available. The various hydrofoils now operating or under trial employ a variety of power systems, with diesel the most widely used. However, gas turbines for smaller vessels and nuclear power for large ships are generally seen as the preferred power for future hydrofoils.

Control systems are as varied as the types of hydrofoils that exist. Determining the effectiveness and the economics of the different control systems is among the major objectives of the various experimental programs now underway. Hydrofoils now being operated or tested are achieving speeds of 40 to 50 knots with the same engines that produce 20-knot speeds in conventional vessels of similar size. Using larger lightweight engines, speeds up to 60 knots are within present capabilities.

A major difficulty in developing large hydrofoils has been the problem of size-weight ratio. For example, if the length of the vessel is doubled, its weight or displacement when loaded is increased approximately eight-fold. If speed remains the same, it will require an eight-fold increase in foil area, or an almost three-fold increase in linear dimensions of the foil, to support the vessel of doubled length. However, by operating at higher speeds, the necessary lift can be obtained with smaller foil area.

One approach toward higher speeds, now under intensive study, is the development of a super-cavitating foil, which could operate at speeds of from 60 to 100 knots, and produce greatly increased lift compared to present sub-cavitating foils of the same dimensions.

Cavitation refers to the formation of cavities or bubbles of water vapor which, as they form and collapse against the foil surface, actually pit the metal in addition to creating turbulence which destroys lift. Cavitation occurs when, due to the high suction produced by the foil under certain conditions, the water pressure drops low enough for the water to vaporize. With present sub-cavitating foils, this becomes so severe at speeds of about 60 knots that it limits them to this speed, just as the sonic barrier limited aircraft before the development of supersonic airfoils. The super-cavitating foil would not eliminate cavitation, but the cavitation would occur behind the foil rather than above it, so that lift would not be affected.

Perfection of the super-cavitating foil should make possible construction of large ocean-going vessels of 1,000 tons and upward, with speeds up to 100 knots, yet with foils small enough in relation to vessel size to be practical from both the economic and operating points of view.

HISTORICAL BACKGROUND ON HYDROFOILS

The hydrofoil concept is not a new one, but its full development has awaited availability of lightweight engines.

The idea has been investigated since the turn of the century when Enrico Forlanini, an Italian, developed an early hydrofoil craft. Wilbur and Orville Wright experimented with hydrofoils at Dayton, Ohio in 1907. In 1919 Alexander Graham Bell, with his *Hydrodrome No. 4*, sped across a Nova Scotia lake at 71 miles per hour, but Bell's death in 1922 ended American hydrofoil research for many years.

In the late 30's and early 40's, several European inventors independently developed hydrofoil craft, among them Baron Hans Von Schertel and Christopher Hook.

In Germany, where Thiedjens had built a successful hydrofoil in 1940, Von Schertel produced a 103-foot, 80-ton hydrofoil for the German Navy at the Schertel Sachsenberg yard at Dessau-Rosslau. Following the war, he moved to Lucerne, Switzerland, forming the firm of Supramar, Ltd. The first Supramar hydrofoil was placed in service in Switzerland in 1952.

Under license from Supramar, a number of other hydrofoils have been built in Europe, most of them at the yards of Leopoldo Rodrigues, Messina, Sicily. The first two large ones, both of the surface-piercing type like all Supramar hydrofoils, were 28-ton vessels which began operations across the Messina Strait in 1955. By 1959 seven had been produced, including the *Flying Fish* which has been demonstrated in the West Indies and on the Pacific Coast, though never placed in operation in the Western Hemisphere. The largest Supramar model to date is a 90-foot one carrying 140 passengers. Several of these are operating in the Mediterranean and between Scandinavian ports on the Baltic.

Hook, an Englishman, escaped from Vichy France in 1942 and developed his first successful hydrofoils in South Africa and Kenya during World War II, using scrap aircraft parts. Hook's hydrofoils, which are of the submerged-foil type, use mechanical feeler arms to sense attitude and adjust the angle of the foil. The system has been widely used on small craft, including one experimental one for the U. S. Navy, but to date no large vessels have employed it.

The Soviet Union's first experimental hydrofoil was tested in 1947, and its first passenger hydrofoil was placed in service on the Volga in 1954. This was followed in 1956 by a 65-passenger vessel, the *Rocket*, and in 1959 by the 150-passenger *Meteor* which attained a 40 to 45-mile-per-hour speed on the Volga between Gorky and Kuibyshev. All were designed by R. Y. Alekseyev and built at the Sormovo Shipyards, Gorky. Since then a 300-passenger and a 700-passenger hydrofoil have also been placed in service.

United States efforts in hydrofoil research lagged until well after World War II. The Office of Naval Research undertook the first real American hydrofoil development program in 1951, when it placed small research and development contracts with eight firms for small experimental hydrofoils, all under 30 feet. Among those completed within the next three to four years were Miami Shipbuilding Company's submerged-foil craft with Hook attitude control, later modified in 1958 to use an automatic pilot in place of mechanical feelers. Another was the *Sea Legs*, a 5-ton, 29-foot submerged-foil craft developed by Gibbs and Cox, naval architects. In 1959, Grumman Aircraft and Engineering Company and its affiliate, Dynamic Developments, Inc., completed a 24-foot, one-ton vessel.

Wilson Shipyard, Inc. of Wilmington, Del., became interested in hydrofoils in the early 1950's, and since then has closely followed developments abroad, as well as pioneer efforts in the United States, in preparation for its own entry into the hydrofoil field. Officials of the company, as well as of its parent, City Investing Company, New York, have conferred extensively with European designers and studied in detail the operations of those hydrofoils in service abroad.

U. S. efforts toward developing larger hydrofoil vessels began in 1959 when the Navy placed a contract with Boeing in Seattle for a 115-foot, 110-ton subchaser, and the Maritime Administration contracted with Grumman and Dynamic Developments to design and build a 104-foot, 90-ton hydrofoil that could carry 100 passengers. The latter project was begun under the direction of the late Charles R. Denison, coordinator of research for the Maritime Administration, who died before the project was completed. The vessel, launched in June 1962, was named the *Denison* in his honor. The *Denison* is now undergoing builder's trials and, if the ship can operate successfully, is expected eventually to be placed in passenger service between Florida and the Bahamas.

Until 1962, no American-built hydrofoil had been approved by the U. S. Coast Guard to carry passengers. The distinction of being the first so approved belongs to Wilson Shipyard's *Albatross*, a 34-foot surface-piercing hydrofoil developed by Hydro-Capital, Inc., of California, and designed by Helmut Kock. Back of its successful development is more than 180,000 hours of engineering. Present plans are to produce 25 other hydrofoils of the same class at Wilson's Wilmington, Delaware, shipyard.

Wilson plans to move into construction of larger hydrofoils based on its studies of the *Albatross* from both an engineering and an economic standpoint, and on actual experience in operating the vessel in passenger service.

Foreign-built vessels are not permitted under Federal law to operate in U. S. coastal service, and the *Albatross* is the first American-built vessel available which can be used to acquire actual operating experience between U. S. ports.

For the future, in addition to Wilson's plans for larger hydrofoils based on its experience with the *Albatross*, the Navy has contracted with Grumman for preliminary design of a 300-ton, 200-foot ocean-going hydrofoil designated AGEH, and Supramar has on its drawing board plans for a 120-foot hydrofoil.