

*Highlighting spinoffs
in the field of transportation is a
technology transfer that
helped improve the ride quality of
a passenger-carrying hydrofoil*

Smooth Passage For The Jetfoil

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This photo of a Boeing Jetfoil shows how the hydrofoils lift the vessel's hull well above the surface, enabling the Jetfoil to cruise at 45 knots because of minimal friction between hull and water.

It is 260 nautical miles across the North Sea from Stavanger on Norway's west coast to Aberdeen in northern Scotland. That's a full day's travel for most conventional ships, a half day for the fastest. Last year a hydrofoil named the *Flying Princess* made a record-breaking crossing in just six hours 11 minutes, underlining the speed and convenience that is attracting more and more travelers to hydrofoil transportation.

The *Flying Princess* is a Boeing Jetfoil, one of a family of commercial

waterjets built by Boeing Marine Systems, a division of The Boeing Company, Seattle, Washington. The new Jetfoil offers a number of advantages over earlier hydrofoils, a major one being a smooth ride in rough waters. NASA technology contributed to jolt-free passenger comfort.

Hydrofoils skim the surface at speeds considerably greater than those of conventional ships because there is little friction between hull and water. Hulls are raised above the water by the lift of the foils, which resemble and function like an airplane wing. The foils are attached to the hull by rigid struts, which ordinarily cause a vessel operating in coastal seas to follow the contour of the waves. In wind-whipped waters, this makes for a rough ride. Seeking to increase passenger acceptance, Boeing Marine System engineers looked for ways to improve rough-water ride quality.

Langley Research Center conducts continuing ride quality research. Initially, it was aimed at improving aircraft ride; it was later expanded to include all modes of transportation. Research includes studies of vibration, acceleration, temperature, humidity, passenger seats and posture, and the psychological aspects of passenger reaction to vehicle ride. As part of the program, Langley developed instrumentation, ride quality models and methods of data analysis. The University of Virginia, a Langley contractor, published a report on the subject and Langley held a Ride Quality Symposium.

A member of the Jetfoil development team attended the symposium and followed up by obtaining additional details of Langley's research. The NASA information led to Boeing's design of a computer-controlled system that automatically changes the pitch of the hydrofoils in response to changes in the water movement, eliminating much of the oscillation experienced by hydrofoils moving rapidly through rough water. The result, the company says, is rough-water ride quality unmatched by competitive craft.

Capable of cruising at 45 knots, the Jetfoil is powered by two waterjets, each driven by a gas turbine engine. The 90-foot, 110-ton, double-decked vessel is offered in various configurations, from a tourist version which

carries 190-250 passengers and their luggage, to a short-haul commuter version which can accommodate up to 400.

Water debris poses no problem for the Jetfoil, since its hydrofoil struts will shatter such obstacles as floating logs. In case the boat encounters something too solid to pierce—an extremely large log or a reef—the Jetfoil has a special design feature; the strut support system folds back, “giving” with the impact so that passengers experience

something like the deceleration pressure of an airliner’s thrust reversal after landing.

The Jetfoil made its operational debut in 1975, operating across the South China Sea from Hong Kong to Macao. In the same year it entered service in the Hawaiian Islands and last year additional services were initiated in Venezuela, Japan and across the English Channel from London to Zeebrugge, Belgium.

The hydrofoil Flying Princess, which last year made a record-breaking run across the North Sea from Norway to Scotland in six hours and 11 minutes. The 190-passenger vessel is now in commercial service, linking London and Zeebrugge, Belgium.

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