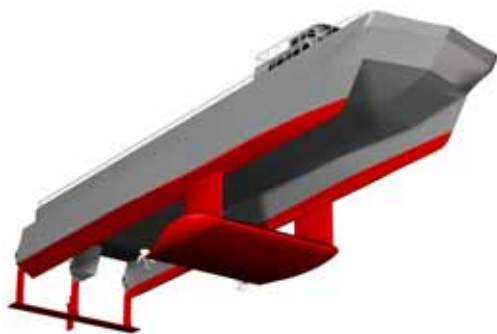


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Navy Completes Successful Sea Trials on Navatek “Lifting Body” Ship



Underwater view of Sea Flyer hull



Sea Flyer during sea trials May 2004

The U.S. Navy has completed successful sea trials on a 160-foot, 320-ton technology demonstrator craft called *Sea Flyer*, which incorporates advanced, underwater “lifting body” technology developed by Navatek Ltd. of Honolulu, Hawaii. The craft was launched in June 2003, with Navy sea trials conducted off Hawaiian waters in 2004. The *Sea Flyer* will depart for San Diego on July 7 to participate in Navy tests and demonstrations off the coast of California over the next six months.

Navatek’s “lifting body” ship combines in one design both the high speed of a hydrofoil and the exceptional rough-water stability of a SWATH ship. Navatek’s patented, underwater “lifting body” technology is applicable to both military and commercial ships. Navatek’s lifting body technology has been supported by the Office of Naval Research and the Navy’s Chief of Naval Operations for risk reduction for the Navy’s latest warship design, the Littoral Combat Ship (LCS). Commercially, the Navatek technology is expected to eventually appear in new commercial ferry designs that will go faster and ride smoother than existing ferry ships.

Navatek is currently in discussions with the U.S. Dept. of Transportation’s Office of Research, Demonstration and Innovation (RDI) to test the technology for ferry use here in Hawaii. The 149-passenger *Foilcat* passenger ferry Navatek used in the Wiki-Wiki ferry demonstration off Oahu two years ago would be re-fitted with a Navatek underwater lifting body. The converted ship would then be tested on two routes never before served by ferries (because of the rough

waters): Molokai to Kahului, and Kahului to Hana. Both communities are underserved in terms of transportation links.

The U.S. Navy's Office of Naval Research in Arlington, VA., supported by the efforts of Hawaii Senator Daniel K. Inouye, funded the \$18 million project, begun in 2000. Preliminary research on underwater lifting body concepts was funded by CEROS (National Defense Center for Excellence for Research in Ocean Sciences). The *Sea Flyer* confirmed on a large scale the benefits of underwater lifting bodies verified on an earlier, small-scale 65-foot, 50-ton Navatek lifting body demonstrator craft called *MIDFOIL*, and originally identified through extensive CFD studies conducted by Navatek using the Maui supercomputer.

During sea trials, the *Sea Flyer* met or exceeded all performance predictions, with results logged through extensive instrumentation. Sea trials were also recorded on video.

- **Top Speed:** The *Sea Flyer* exceeded its target top speed, recording a sustained top speed of more than 30 knots.
- **Maintaining Speed in Seaway:** More impressively, during tests in 8 to 14-foot seas with 40 knots wind (sea state 5), the *Sea Flyer* was able to maintain an average cruise speed just one knot less than its calm water cruise speed. Observers on the *Sea Flyer* during this test included Commander Hank Teuton, from the U.S. Coast Guard's R&D headquarters office, and a former skipper of the vessel before it was converted from an SES to a lifting body ship. Teuton called the performance "remarkable." He noted that a much larger 378-foot Coast Guard cutter would have to reduce speed from 27 to 22 knots in similar seas.
- **Motions:** The *Sea Flyer* demonstrated exceptionally stable motions in rough seas. During tests in those same 8 to 14 foot seas, the *Sea Flyer* recorded vertical ship accelerations on the order of only 0.07g rms.
- **Maneuverability and Turning:** The *Sea Flyer* carries a Navatek-developed advanced ride control system that allowed the craft to conduct a high-speed, 360-degree turn at 27 knots in 12-foot seas while maintaining a commanded 3 degree bank through all headings.
- **Predicted vs. Actual Performance:** Sea trials confirmed a very close match between actual and predicted performance, validating Navatek's computational fluid dynamics (CFD) computer codes used to design the *Sea Flyer*.

A former U.S. Navy Surface Effect Ship (SES-200) provided the parent hull of the *Sea Flyer*, reducing project costs. During the two-year project, Navatek removed the existing SES air lift system and all related components, and installed a 170-ton Navatek underwater lifting body incorporating a new propulsion drivetrain (engines, gearboxes, shafts and propellers) within the lifting body. This allows the craft to be operated with variable immersion as speed increases, with the parent hull fully out of the water at maximum speed. An aft crossfoil was also added for pitch stabilization and control, along with a proprietary Navatek advanced ride control system (ARCS).



In addition to the multi-hull *Sea Flyer* lifting body demonstrator craft, Navatek is currently building a second, large-scale, lifting body technology demonstrator craft, the *HDV® 100*. This program is designed to demonstrate the benefits of lifting body technology for monohull craft. The 100-foot, 100-ton, 50-knot *HDV® 100* employs an anti-slamming, deep-vee monohull as the parent hull, mated to a Navatek “blended-wing” underwater lifting body. Scheduled launch date for the *HDV® 100* is late 2004.

Navatek, Ltd., a wholly-owned subsidiary of Pacific Marine, operates out of offices in Honolulu, Hawaii. It’s primary government customer is the U.S. Navy’s Office of Naval Research (ONR). Through its work on advanced hull forms for the U.S. military, the company has helped develop advanced Computational Fluid Dynamics software and become a world leader in the design, construction and testing of underwater lifting bodies that can make a broad range of conventional hull forms (including monohulls, catamarans, trimarans, small waterplane area ships as well as deep-vee, partial hydrofoil and hydrofoil hull forms) more stable at zero speed and more efficient at higher speeds, as well as give them extended range.

Navatek Ltd. performs some of its CFD analyses using the Maui High Performance Computing Center supercomputer. The MHPCC is the 12th largest computing center in the world. Navatek also operates a 128-processor Linux cluster at the Navatek headquarters in Honolulu.

Navatek, Ltd. partners with other private companies, universities, government agencies and consortia in its R&D work. These include corporations Lockheed Martin, Northrop Grumman, General Dynamics, Electric Boat, SAIC, Cortana and Bath Iron Works; educational institutions such as the University of Hawaii, Massachusetts Institute of Technology (MIT), California State University-Long Beach, Mississippi State, Penn State, and University of Maine; and government agencies such as the U.S. Navy, the Office of Naval Research, the U.S. Dept. of Defense, the Defense Advanced Research Projects Agency (DARPA), the Center for the

Commercial Deployment of Transportation Technologies (CCDOTT), and the Center for Excellence in Research in Ocean Sciences (CEROS).

Navatek Ltd. parent company Pacific Marine, founded in 1944, is a privately-owned Hawaii corporation with 400 employees and annual sales of \$96 million in FY 2003. Pacific Marine is majority partner in Pacific Shipyards International LLC, Hawaii's largest commercial ship repair facility.