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## Engineering gnarly waves

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### New technology aims to make surf machines more realistic

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SOLANA BEACH – In a crowded shed next to his Solana Beach house, just beyond the lawn mower and the surfboards hanging on the walls, Bruce McFarland tinkered for months trying to create the perfect wave.

The aerospace engineer pumped water through a homemade fiberglass tub about the size of a longboard. He used tin snips to create contours along the tub's bottom to produce a stationary wave. The idea was to develop a better artificial wave technology than the current systems used in water parks – one producing waves that felt more like real surfing.

That was seven years ago. Today, McFarland is president of American Wave Machines. That scale model he toyed with in his shed has evolved into SurfStream, a wave machine for water parks, hotel/resorts and action sports venues.

The machine creates a wave that stays in one place in the pool, with water flowing at natural gravity-fed speeds. Surfers can ride the stationary wave using a real surfboard, which is not the case with machines installed at many water parks.

McFarland, an avid surfer, says that SurfStream provides a sought-after “long-ride” type of surfing experience.

“Surfing has become a staple at water parks and resorts around the world,” McFarland said. “The current technology was first invented in the '70s and introduced as a water park attraction in the '90s. I was interested in a system that was more like ocean surfing.”



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American Wave Machines President Bruce McFarland (right) and Steven Ream, owner of Fiber Reinforced Products, inspected a panel that will be part of a wave machine.

McFarland and his wife, Marie, also an aerospace engineer, introduced SurfStream at an amusement industry trade show in 2005. They installed a prototype tank at a park in New Jersey a few months later. Today, they have a handful of orders from what they call early adopters of the technology.

But they're betting that SurfStream will become the next stage in artificial surfing technology for the amusement park industry.

Current wave machines typically come in two types.

One creates a wave that travels along a pool, breaking at some point in the process. These pools require large pumps to create waves big enough to surf, McFarland said. That's expensive and uses a lot of energy, so most parks with these machines have geared them toward inner tubing where smaller waves are needed.

The more common system creates an artificial, surflike experience but it's not really on a wave at all. Called a sheet flow device, this system shoots a shallow jet of fast-moving water up a wide, contoured sheet of plastic. Riders glide on the thin sheet of water on a special board.

Wave Loch of San Diego is a leader in sheet-flow artificial-wave systems, with about 80 installed and operating and another 20 on order, said Tom Lochtefeld, owner of Wave Loch.

McFarland, who was a part owner of a Wave Loch subsidiary before starting his own company, said the sheet-flow experience does not mimic real surfing as closely as his SurfStream.

SurfStream creates a stationary wave by flowing water over subtle contours along the bottom of a tank. It can be adjusted to create waves of different sizes, or simply create a small white wave for body boarding.

The idea for the standing wave machine came from Ken Hill, who was inspired by a phenomenon he witnessed on a river near Waimea Bay in Hawaii.

Hill, a body boarder, saw a wave created in the river and hatched the idea of re-creating it artificially. He licensed the idea for a stationary wave device. He met McFarland and the two teamed up to attempt a system that would reproduce the river wave.

“Trying to get the phenomenon we saw in the river, which was a standing wave, and create that in a way that was stable and safe so it could be an amusement attraction, that took awhile,” McFarland said.

McFarland declines to say how many orders the company has, but he contends that the firm's systems are catching on with water parks and other attractions.

Lochtefeld, the Wave Loch owner who also is developing a system that will allow surfers to use real boards, said SurfStream-style wave machines can be more expensive because they must “move a lot of water.”

“It's a tough battle because energy costs are so high,” he said. “So your ability to create a wave that competes with Mother Nature is extremely difficult. The economics of making the operation viable, that's the question.”



CHARLIE NEUMAN / Union-Tribune  
Surfers can ride the stationary wave using a real surfboard.

McFarland, however, said SurfStream is competitive with sheet-flow systems because it's not pumping water at high speeds and is using gravity to help create the wave.

As with sheet-flow systems, only one surfer at a time can ride SurfStream. Five body boarders, however, can ride a SurfStream wave simultaneously, McFarland said.

“If you look at the cost per rider, it gets less expensive,” he said.

SurfStream prices start at \$250,000 and can reach \$2 million or more. “It's really like water slides,” Marie McFarland said. “It depends on the size.”

In addition to SurfStream, American Wave Machines also sells wave-generating pumps called PerfectSwell for surf pools. Developed with partners Carl Ekstrom and Flometrics, they use a pneumatic system to generate traveling waves in surf pools that mimic ocean waves.

The company delivered its first PerfectSwell wave generator to the Aquarium of the Pacific in Long Beach for use in its yearlong exhibit called Catch a Wave. The exhibit, which opened in May, demonstrates the difference between tsunami waves and wind waves.