Higganum Inventor Says: Pakayak!

by **Tanja Buzzi Moriarty**

Higganum couple Doug and Zinelle Mackro are looking to make a splash with their new invention called Pakayak™, (pronounced Pack-A-Yak) the world's first sectional nesting kayak system.

Pakayak is essentially a kayak that comes in six pieces and stacks to 1/4 of the size of a regular kayak. Assembled, the first Pakayak will be a 14-foot sea/touring kayak with hatches fore and aft, deck webbing, and is outfitted to accept a rudder. Yet it packs into a 3½-foot-tall bag.

"You can carry it in a duffel bag, in a backpack or as wheeled luggage," Zinelle Mackro explained.

Pakayak™ is registered as an LLC home business, a division of Dexxco, and is headquartered in Higganum in the couple's home. It is their base for marketing, communications, research, development, testing and consumer relations.

The couple is a well-suited business team. For years they have worked out of their home in separate business ventures. Doug, alum of Haddam-Killingworth, class of 1983, is the owner of Detailed Construction since 1985, (*www.detailedconstructionllc.com.*) He is a builder, contractor and inventor. Zinelle is president of Z Design Group (*www.zdesigngrp.com)* a graphic design and web development company since 2001.

Zinelle handles the marketing, graphics, web design, customer service and sales of Pakayak.

"I've got that side covered," she grinned. "Doug's got the inventor's brain."

Idea 20 Years In the Making

Twenty years ago, Doug conceived the idea to create a kayak that would come apart, nest to luggage size and go back together to paddle anywhere you could carry it.

Doug and Zinelle Mackro embarking on an invention adventure!

"I did a lot of river paddling, with lots of loading and unloading…more loading and unloading than paddling," he said.

"I needed a roof rack, a place to store it. I thought there had to be an easier way if it were in sections."

Implementing the idea was a monumental endeavor, Doug explained. "It wasn't the right time. Knowing what I now know, it would have been nearly impossible to do this back then. The technology needed and the advances in manufacturing have just recently allowed this to be a reality. Also, without the support from Zinelle, I would never have attempted it."

With Zinelle's encouragement, the couple began exploring to see if such a kayak had already been invented. With the aid of a patent attorney it appeared it had not. After the couple applied for a provisional patent application through the U.S. patent office, Doug made a prototype to test the concept. He used one of their friends' broken wooden kayaks to see if it was feasible.

"It had been broken in half as a result of a loose tie-down being caught under the front wheel while in transport (a possibility eliminated by the Pakayak)," he said.

Doug reassembled the broken kayak, and then he cut it in half. He used an old truck tire inner tube for a gasket and with his friend Al Guk of Killingworth, modified four clamps to hold it together. When he tested the crude prototype in the cold spring water, he proved that the concept would work.

This motivated the couple to seek out kayak manufacturers for their interest and assistance. With the help of one of Zinelle's friends, Des McEttrick, a sell sheet was created and the business

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plan was started. In 2012, Doug met with Confluence Outdoor, one of the largest kayak manufacturers in the country in Greenville, S.C.

"They said [a nesting kayak] was a good option, a viable product, but they weren't convinced the concept would be possible to manufacture in plastic. They told me to prove it could be done. And, with a few tips from them on how to weld plastic, that's what I did."

Deciding to Go It Alone

As he left the meeting, Doug realized that he would not get assistance from a kayak manufacturer without being ready to go to market with the concept. He and Zinelle then decided, "if we have to do all the work, then we are going to keep the company ours."

The small company decided they would not seek launching Pakayak through a huge company. At that point Doug went back to his Higganum basement and sacrificed his plastic kayak, aptly named, Frankenstein. "I bisected it and retrofitted the mating surface with rubber gaskets. It worked perfectly!"

3-D Printed Design Prototype

They then got to work to measure out a fourteen-foot kayak that could be made into six sections. It was at this point that Phil Miller of North Haven and Day Moore of Milford came on board to create the core team of Pakayak. Phil spent two weekends helping Doug create the cross section rib shapes of a kayak on graph paper while Day was helping Zinelle with the business plan and social media.

After the painstaking work of transferring the hull design to paper came the tedious job of making sense of the geometry. Phil was attempting to convert the rib shapes into radii and angles for use by a CAD designer to recreate the hull in SolidWorks.

SolidWorks is a program, now widely used, that creates three-dimensional blueprints of objects that can then be manufactured.

Zinelle realized what they were doing and offered to scan and trace the sketches in Illustrator, a drawing program she uses for her graphic design business. This likely saved weeks of effort and gave a better method to give the shapes to a CAD designer. Once the files were loaded into the program, Doug and Zinelle worked together to adjust the shapes to allow them to nest into one another for packing.

"It took a lot of tweaking to make sure the boat would stack properly with the fittings," Doug said. "That gave us the

initial "blueprint" to give to the computer design guru who could translate it into a Solidworks 3-D model. To find the right person who knew how to use the right program became one of our biggest challenges."

About the time the 3-D blueprint was being completed, the Mackros met Jim Buys, also of Higganum.

Buys, an engineering teacher at Avon High School, brought the Mackro's plans into his engineering class and assigned one of his students to print out a 3-D model at a .15 scale of the actual 14-foot-sized kayak on a three dimensional printer.

"The computer generated image is fed into a printer," explained Buys. "It's as if a glue gun and jet printer had a baby," he joked. The shape was printed out in layers of plastic in three dimensions.

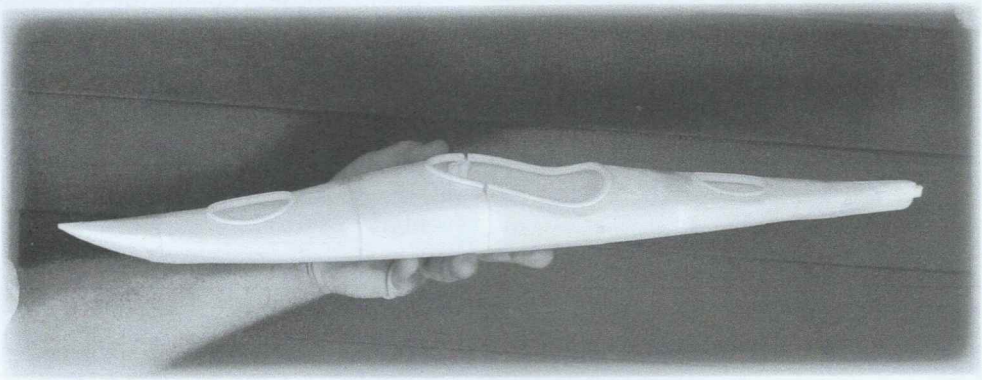
Buys brought the six-piece Barbie-doll-sized kayak to the Mackros.

"Jim put it in our mailbox like it was no big deal," Zinelle said. "After all the work and getting it properly sized, it was like Christmas for us to finally touch it!"

Then the Mackros had to find a company who could manufacture a life-size prototype for them on a huge 3-D printer so they could fine-tune the model before bringing it into full production with rotational molding. They found a company in Houston to print out a full-size 3-D in polycarbonate.

"There are only about four companies in the world that can 3-D print something this large. We contacted three of them," Zinelle said. "It's such new technology. That size, the largest being 42 inches, is almost impossible to print out. It takes a week to print out each of the six pieces."

After they have a life-size plastic molding and straighten out any of the last



Assembled Pakayak Model

kinks, the Pakayak boats will be made using a sturdy rotational molding process.

"A mold of each of the pieces will be made," Doug explained. "Plastic powder will be inserted in each piece, then heated and spun around and around to equally distribute the plastic on the inside. When cool, there will be a skin inside made of plastic that is stable with no weak spots. It's the same method used to make most kayaks," Doug said.

Pakayaks will be made out of high-density polyethylene (HDPE). "The same stuff milk jugs, Tupperware, and 5-gallon Home Depot buckets are made of, almost indestructible plastic," described Doug.

Manufacturing will be done in Atlanta. "The manufacturer there is Atlanta Rotational Molding. The owner has 36 years of experience in roto-molding as well as some 20 years producing roto-molded kayaks. We are very excited about working with someone with his specific knowledge. It's also an ideal location for distribution because of its central location on the eastern coast. This will minimize the shipping costs and help us to keep the carbon footprint of the company low."

Six Pieces: How Does It Stay Together?

Their six-piece Pakayak kayaks are watertight because of the patented gasket and clamp system the Mackros have

Nested Pakayak model

developed. "There's nothing radically new with the seal concept. It's been used for the past 50 or 60 years in the industry," Doug said. "We're just taking it into the kayak world."

Best example he said is in the scuba industry. "Camera and flashlights use the exact same sealing technique that takes the same seal 200 to 400 feet deep where the pressure is phenomenal. A kayak only has surface pressure. It is safe to say that one clamp could fail and you will still have a watertight boat," Doug said.

When Do You Get to See It?

You can go to *pakayak.com* to follow the process and get the latest information on their Kickstarter.com Campaign. They will launch their 30-day campaign starting the end of September.

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They are seeking about $300,000 in crowdfunding and are competing for an Impact Challenge grant to fund start-up production, tooling and the first round of producing the first Pakayak fleet. "We need to get maximum exposure and we are getting our name out there for pre-sales."

Funders on Kickstarter will receive a reward based on the level of their donation including stickers, organic cotton hats, organic cotton T-shirts, dry bag (to keep items water tight), a water bottle with cartridge that can be reused up to 300 times, a cooler and, of course, a Pakayak.

"This is also the best time for people to buy a limited edition Pakayak that will only be offered through the Kickstarter campaign," Zinelle said. It will be a few hundred dollars off the expected retail price of $1,695.

Protecting Endangered Animals and Raising Ocean Awareness

Pakayak wants to steer the company to be eco-friendly and to save endangered species.

"We want to save the world and stay as eco-friendly as possible," Zinelle said. "Plastic is obviously not eco-friendly," Zinelle admits, "but we are naming each model after an endangered species including the Bluefin tuna, pink dolphin, mako shark, polar bear, and blue whale. We will give a portion of each Pakayak sale to responsible charitable organizations that represent each particular species."

"We also want to aid in the conservation and awareness of the conditions of the world's oceans," Doug added.

They plan to post updates about the animals and oceans on their website and through their social media.

Other local folks who've been instrumental in Pakayak's development are Chris Cubeta and Tom and Nancy Prue of Higganum.

Tanja Moriarty is a Higganum resident and freelance writer whose work is online at www.tanjabuzzimoriarty.com.