Cornell, ADC tackling rescue ropes issue for U.S. Navy copters

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Engineers from Advanced Design Consulting in Lansing, New York meet with Cornell graduate students, led by professor Stuart Leigh Phoenix (pointing), in the machine shop of ADC's Ridge Road facility. Pictured, left to right, are master's students Timothy Lai and Sarah Choe; Phoenix; ADC engineer Brian Hoza and Director of Operations Eric Van Every; master's student Matias Werner; and ADC President Alex Deyhim, M.Eng '93, MBA '98.

When you're dangling above the ocean or the side of a mountain, suspended from a rescue helicopter, having to worry about anything except the mission at hand is the last thing you need.

But Navy Aviation Rescue Swimmers, whose life-saving jobs are done at the end of a cable less than a quarter-inch thick, are dealing with exactly that kind of problem - namely, a jolt of static electricity due to the conductivity of the steel cables on which they descend. And a team of engineering faculty and students from Cornell and engineers from Advanced Design Consulting (ADC) of Lansing, New York, is intent on solving the problem.

The U.S. Navy has commissioned Cornell and ADC to come up with a replacement for the current steel cables used in helicopter rescue systems. They are partnering with Cortland Cable, which is producing materials the collaborators are testing as possible replacements for the steel currently used by the military.

Funding for the project is through the Cornell Center for Materials Research's JumpStart Program, which has helped 71 New York state small businesses develop and improve their products through university collaborations.

JumpStart projects receive up to $5,000 in matching funds for project costs that include faculty and research staff, facilities, services, supplies and materials. ADC is one of four companies that received JumpStart funding this past semester.

The Navy's existing rescue rope system is perfectly suited for the actual rescue procedure, but has a very dangerous side effect. As the rescuer is lowered from the helicopter on the cable, the dry air that swirls around the helicopter and passes over the cable causes a build-up of static electricity.

This causes rescuers to get a major jolt of static electricity when they hit the water or the ground holding the cable, unless they get the cable end to hit the ground first - not always easy to arrange in a crisis situation.

"How do you get rid of that?" asked Stuart Leigh Phoenix , professor in the Sibley School of Mechanical and Aerospace Engineering , who's working with ADC engineers on the problem along with three of his master's students - Sarah Choe, Timothy Lai and Matias Werner.

"Well, in the water, if you handle it right, you can make sure that the cable goes in first before anybody grabs it, but that's kind of iffy," said Phoenix, who worked with the military in the 1980s, helping to design a cable used in rocket prototype testing at White Sands Missile Range in New Mexico. "But on open land or the side of a mountain, you may not have anywhere to ground it."

"The dryer the air, the more static you're going to get," said Eric Van Every, ADC's director of operations. "So in the desert, it'll pretty much knock you right out in certain cases."

The researchers have developed several prototypes using a liquid crystal polymer material, Vectran, and are in the process of designing a test rig that can simulate the stress put on these cables in rescue situations.

One of the challenges with the new material involves the winch system used to wind the cable onto a reel. In testing, the new rope is very strong, but has been found to burrow into the layers of rope underneath as it's being reeled in. Thus, coming up with the proper "jacket," or coating, along with a slight re-engineering of the winch drive will be necessary. With many winch designs in service now, coming up with a simple, versatile retrofit would be optimal.

The Cornell-ADC collaboration has been beneficial for both sides, according to company president and Cornellian Alex Deyhim, who earned his master's in mechanical engineering in 1993 - as a member of Phoenix's lab group - and his MBA five years later. He founded ADC in 1995.

"The working relationship with the students has been excellent," said Deyhim, who meets with the students and his engineers every two weeks to discuss ideas and information. Their meetings will resume after summer break.

The relationship is giving the students a taste of life after college.

"Suddenly, they're not working on some hypothetical project, and ultimately, we're solving something that's going to help our men and women in uniform," Deyhim said. "That's pretty cool, that's a really good feeling."

The students, who chose this collaboration from several master's project options, also see the relationship as a unique and valuable opportunity.

"Its effect on the real world is what really drew me to it," Choe said. "In the classroom, you don't really know the meaning behind all the problems you're dealing with, but here it's a very applicable setting so it's really exciting just be involved in this."

"Right from the get-go, a lot of the things that we were looking at were things that we'd never seen before in a classroom, so for sure there was a pretty big learning curve," Lai said.

"This definitely improves my skill set and makes me more marketable," Werner said. "I'm able to say to someone that I've had this experience, working on a real problem."

The collaboration will continue in the fall semester, the final one for each of the students.