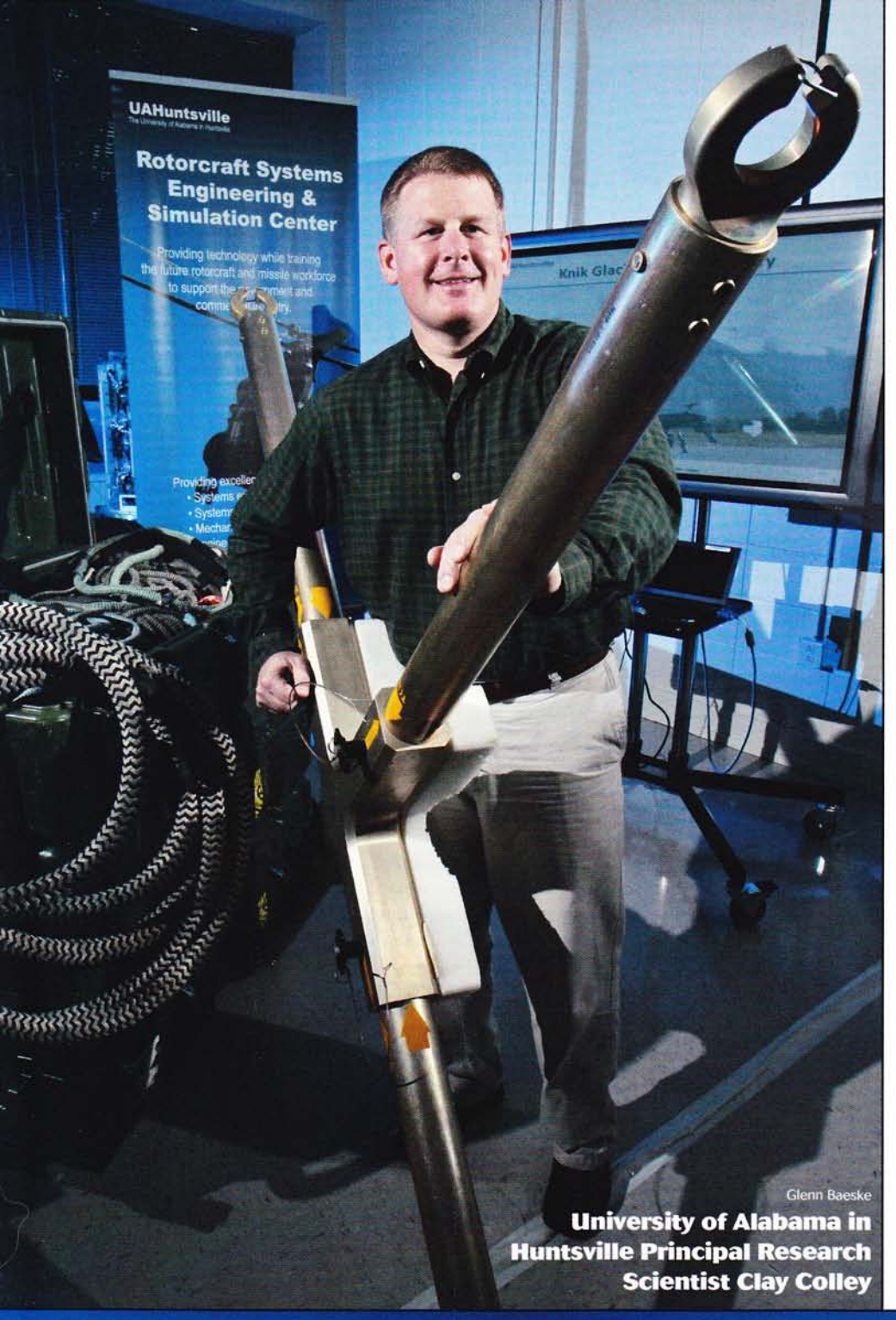

Glenn Baeske
University of Alabama in Huntsville Principal Research Scientist Clay Colley

GEE WHIZ

By Diana LaChance

Pickup lines

Recovery equipment redesigned at UAH means fewer destroyed helicopters

In the daring raid on Osama bin Laden's compound in Pakistan in May, Navy SEAL operatives were forced to destroy the MH-60 Black Hawk helicopter that crash-landed upon arrival. But as drastic as that sounds – especially considering each of these twin-engine, medium-lift aircraft costs tens of millions of dollars – destroying crash-damaged helicopters has been an accepted practice in the Army since helicopters were first used in the theater of war. There's even a term for it, says Clay Colley. "They say the aircraft is 'blown in place.' "

But fewer down helicopters may be lost in the future. The principle research scientist at the University of Huntsville in Alabama's Rotorcraft Systems Engineering and Simulation Center (RSESC), Colley and his colleagues have been revamping the Army's approach toward recovering disabled choppers, a task given them by the Aviation Ground Support Equipment Project Manager. Currently, they are finalizing the redesign of the Army's Unit Maintenance Aerial Recovery Kit (UMARK) to expand the number of configurations that can be used to recover disabled aircraft.

"The UMARK has been around for 20 years, but we're updating it to cover eighteen different lift configurations for the six main helicopters the Army uses," says Colley, referring to the CH-47 Chinook, UH-60 Blackhawk, AH-64 Apache, OH-58 Kiowa Warrior, MQ-1C Gray Eagle Unmanned Aerial Vehicle and the UH-72 Lakota. The update will also allow for the recovery of crash-damaged helicopters, something the old version of the UMARK did not accommodate.

"Until now," says Colley, "the UMARK was only able to recover disabled helicopters." In other words, helicopters landed as a result of a cockpit warning. "And while the Army has been able to recover some crash-damaged helicopters in the past, there's never been a procedure written for it, something that can be trained and is consistent across all the aircraft." As a result, crash-damaged choppers were often blown in place to avoid the risk to personnel and equipment posed by a recovery mission in a possibly dangerous area.

"What we've done," says Colley, "is modify the current design so that we're able to recover aircraft that we couldn't before."

RECOVERY BENEFITS

There are a lot of valuable assets that can be recovered from crash-damaged helicopters, from electronic components to fire control systems, even if the helicopter itself can't be flown again, Colley says. And by recovering and reusing these components, the Army can ensure that helicopter readiness rates remain high. "In a wartime effort, when aircraft readiness is a big deal, the Army doesn't want to be waiting on a new helicopter to be built from scratch," says Colley. "Not to mention there's a cost savings as well, in a time of shrinking budgets."

To execute the UMARK redesign, Colley and engineers Jason Carter, Betsy Petersen, Casey Carden and Daniel Morrow first performed a detailed design and analysis of each configuration using a combination of commercial design software and software that they developed themselves. "We have a fairly significant software development capability here, but we also used ProE for 3-D CAD to generate our designs, as well as finite element analysis software like NASTRAN and PATRAN," says Colley. "Then we used our in-house machine shop to manufacture the hardware, subcontracting out anything that exceeded the shop's capabilities via the university's bid system."

While that might conjure visions of clunky metal parts and large pieces of equipment, the UMARK is remarkably compact, fitting into three moderately sized cases – and even those may be pared down. "Inside are slings, two shackles, spreader bars, and blade bag components," says Colley, explaining that the blade bags are used hold the rotor blades in place while the helicopter is being lifted. Each item is carefully labeled and matched to each helicopter and the configurations that the UMARK can accommodate. After all, "you can't use the same tools and lifting equipment for all helicopters because the airframes are all different, as are the physical locations for recovery on each helicopter," says Colley. "That's why we have written procedures that detail what that damage could be and how to approach it."

The process is akin to jacking up a car to change the tire. Lining up the jack with the factory-approved jacking points is critical to avoid damage to both the car and the person changing the tire. Like cars, helicopters have points called hard points. These hard points allow the helicopter to be lifted without putting undue pressure on the airframe. The kit provides components that can be secured to a helicopter's hard points, as well as fittings needed to allow for lift. "Each configuration can involve three or four hard points to ensure a balanced lift," says Colley.

With crash-damaged helicopters, the situation becomes somewhat trickier. "In some cases, there won't be easily accessible hard points to lift a crash-damaged

helicopter," says Colley. "It's even harder when the airframe itself is compromised, as it might not have the strength needed to withstand the loads while it's being flown." That's why the kit has been redesigned to accommodate so many configurations. "The old kit, while designed the same way, wasn't intended to pick up crash-damaged aircraft, so it didn't have the hardware," says Colley. "But now the chances are greater that we will be able to use an intact hard point, whether at the top or the bottom of a helicopter."

The RSESC's next step is to ground test each of the configuration-specific designs, much of which Colley and his team will be able to do on Redstone Arsenal using a crane to simulate the lift. It's the flight testing phase that will pose the greatest challenge, given that the team will need to find available and accessible crash-damaged examples of the different flight configurations on which to experiment. Fortunately, the Army has some crash-damaged helicopters on hand at the Corpus Christi Army Depot in Texas and at the Army's National Training Center in Fort Irwin, Calif. As for the other damage configurations, says Colley, researchers will "just need to be ready to test and then wait for an opportunity to arise."

Colley already knows the satisfaction of seeing the UMARK redesign in actual use. In August 2010, he and his team "were right in the middle of our

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Principal Research Scientist Clay Colley, left, with the UMARK team members. From left are Sue O'Brien, Rotorcraft Systems Engineering and Simulation Center acting director; Casey Carden, student specialist; and Jason Carter, research engineer. On the table are metal prototype External Stores Support System (ESSS) fittings developed by the team.

design effort on the UMARK when the Alaska National Guard called to say they had a UH-60 Black Hawk that had rolled over and was upside down in a crevasse on Knik Glacier, near Anchorage, Alaska," he says. "We had just finished the new hardware for that configuration and had the procedures written, but we were flying by night."

Still, with the Army counting on RSESC to help, the team gathered the designs and drawing they had already completed for the parts that would interface with the UH-60, and "with some cooperation from NASA and the Army, we got them built in two days, including shipping," says Colley.

Colley and Carter then flew out to Alaska to oversee the recovery operation and advise the Downed Aircraft Recovery Team (DART). "We told them 'This is how you can do it,' so they went up there and rigged the aircraft using the parts we had designed and built," says Colley. "In the end, the DART did it a little differently, because what we had proposed was new and they weren't familiar with it, but they were able to fly it out safely with a CH-47 Chinook."

Colley says the reaction on the ground was nothing short of elation. "People were cheering, mainly because nobody had been hurt. They were able to recover the personnel and the aircraft, and they were able to fix it because it was still in excellent shape." The success of the mission suggests that the Army will ultimately approve the redesign. In fact, Colley is hopeful that the new UMARK will be applied to the theater of war sometime next year. If that's the case, more helicopters that were once blown in place like the one used in the bin Laden mission may soon find their way back home for repair and reuse. ■