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TRUE GRIT

By Mary Lord

GROWING UP POOR IN A LARGE FAMILY, UNIVERSITY OF COLORADO PROFESSOR JACKIE SULLIVAN FORGED A REMARKABLY SUCCESSFUL CAREER, FROM CLIMBING THE CORPORATE LADDER AT EDS TO TURNING YOUNGSTERS ON TO ENGINEERING.

It's a blistering summer morning. But climate control remains far from the minds of the young Denver-area teens, minorities, girls, and low-income youngsters. They happily huddle in a cramped classroom, brainstorming cool features for the remote-controlled model "green" houses they must then construct. One group dismisses doorbells ("too boring!") in favor of an automatic doggy door. Others envision escalators, hot tubs, even a disco ball. Rock music wafts from a corner. This is engineering education?

The intense woman with piercing blue eyes surveying this creative cacophony clearly thinks so. Distinguished only by a nametag, "Jackie" moves from bench to bench, prodding imaginations toward solar panels and energy conservation. "What uses a lot of power in a house—365 days a year?" she asks three boys designing a Hawaiian mansion. "Bingo! Hot water."

The students, 9th graders in the Denver School of Science and Technology's inaugural class, don't know this unassuming University of Colorado-Boulder professor helped launch their new charter school or pushed to ensure enrollment of underserved populations. They don't realize this weeklong "Creative Engineering" workshop is just one of many such outreach initiatives she coordinates to get kids jazzed about engineering. Nor do they have a clue about her business and academic accomplishments, which include nine years as the top woman on the technical side of EDS.

And that's just how Jacquelyn F. Sullivan, the founding co-director of the innovative Integrated Technology and Learning Program at UCB's college of engineering and applied science, wants it. "Please go easy on the me part," she begs, calling herself "a great conductor" of talent rather than the program's sole star. "I subscribe to the concept that there is no 'I' in 'team'."

The team in question is the energetic band of fellow professors, graduate students, and staff that orchestrate one of the nation's most imaginative engineering-outreach programs. Offerings include college prep engineering design classes in which Native American high schoolers build stereo speakers, "Girls Embrace Technology" camps, and teacher workshops that utilize GPS locators—and these are just a summer sampling. The goal of all this: to coax more girls, minorities, and other underrepresented youngsters into engineering by starting early and making it fun and relevant to their lives.

The team may supply the sweat, but Sullivan's vision drives the mission. If she is a crusader, it's because her horizons were once limited, too. Growing up poor on a Michigan dairy farm, Jackie never dreamed she would wind up an engineer and scholar. "Academics were not on my screen," she recalls.

Indeed, just getting through school was a challenge. Chores began before dawn, and none of the Sullivan children could dash down their dirt road for the bus until they milked all 72 cows. Heeding her 5th grade teacher's advice to think of education as "a way out," Jackie would read books in the unheated attic or under the blanket of the bed she shared with her sister.

Though she "blew the roof" off standardized tests, Jackie never earned great grades in high school, preferring to play guitar in a girl band. When she sought college advice, the guidance counselor tried to steer her toward secretarial school. At the time, recounts Jackie, "I didn't have a clue about what I was going to do." Farm life instilled traits that helped fuel an interest in engineering and a passion for helping underdog kids. "I was lucky, resourceful, and resilient," she says. Running the dairy operation—Jackie's reward for coaxing more milk from the cows than her brothers—honed her strong work ethic.

Jackie enrolled in Olivet College, a tiny liberal arts college 150 miles from home. Just 17, she arrived with no study skills and probably would "have blown out mid-year" had her biology professor not noticed that she knew all the answers in class. He began assigning her daily research questions that he then quizzed her on the next afternoon. Before long, Jackie discovered she not only knew how to study and "could compete if I decided to, but that I could set the curve in class." She soon was earning A's and assisting the professor. "It's all about confidence," she says.

A DEFINING EVENT

The experience—and reading Rachel Carson's environmental classic, *Silent Spring*—whetted Jackie's interest in protecting the environment. And that led her to the environmental field, which is "all about imagining a better world and going about creating it." After getting her bachelor's degree she applied to the University of Michigan intending to study the effects of Agent Orange in aquatic ecosystems. But the program wouldn't send a woman to Vietnam for fieldwork. So she emerged, at the age of 25, with a Ph.D. from Purdue.

After working her way through school, Jackie left academia for industry, planning one day to return. She quickly found her niche on engineering's frontier, first at the Idaho National Engineering Laboratory, where she launched the environmental division, and later at the Denver office of EDS leading large teams of software engineers. Among her projects: helping General Motors develop just-in-time manufacturing. "I couldn't believe people paid me to do work I loved," Jackie says. It seemed that she always ended up in charge. "I'm good at seeing the big picture, for what can be done, not what needs to be done," she explains. Her genius lay in sizing up customer needs, then building the team that could solve the problem.

The call back to campus came in 1990, when UCB's engineering college dean asked Jackie to take over a foundering water resources engineering research center. "Clean it up or shut it down," he charged her. She had a great job at EDS, but Jackie relishes challenge and this was a doozy: a complex water-management decision support and modeling system for the Colorado River that involved considering everything from fluid dynamics to complex Western water policy.

Jackie saw that to rescue the research center she had to redeploy talent and hold everyone, including herself, to tight deadlines and budgets. That same vision infuses every nook of the Integrated Technology and Learning Laboratory, the hands-on engineering facility she co-lead the creation of in 1992. The dean wanted a facility that would encourage interdisciplinary collaborative learning. What emerged was a wholesale revamping of the undergraduate program to put first-year students onto the design-shop floor.

Jackie and a team of faculty members spent a year on the educational concept. They visited cutting-edge programs nationwide, and had architects tour the San Francisco Exploratorium to get a feel for the kind of interactive, engaging projects that would spark student interest. The result may be the most whimsical engineering building on any campus. Hands-on interactive exhibits abound. Articles about student inventors and women engineers vie for wall space with exhibits explaining fluid dynamics.

Jackie brought to academia from industry (along with customer focus) a focus on results. While she encourages her colleagues to take risks, and—yes—make mistakes, ("I screw up every day," she says), in the end her team must deliver. Thus, along with all these K-12 outreach initiatives comes a commitment to measure how well they work. Are kids going into engineering after taking pre-college courses? Do single-sex classes for girls boost confidence and interest in pursuing science, math, and engineering? Jackie needs to justify these programs to sponsors, and if they aren't effective, she will shut them down. Case in point—killing off a science of sound and acoustics camp that all the engineers thought sounded cool but received a lukewarm reception from the kids.

Her K-12 engineering team continues to roll out new projects. Their latest passion: TeachEngineering.com, a digital library of standards-based engineering lessons and hands-on activities, searchable by grade and discipline. Using engineering as a vehicle for the integration of science and math, teachers won't have to reinvent the wheel.

Meanwhile, Jackie has been wrestling with home-front challenges as well. Diagnosed with breast cancer this past spring, she underwent her last radiation treatment—jetting to ASEE's annual meeting just 14 hours later, giving one of the mini-plenary talks on K-12 engineering. She insists that cancer hasn't slowed her, apart from causing her to pause and wonder why she drives herself so hard. Beyond sending her first daughter off to college this fall and planning a kayak trip in a remote corner of Canada, Jackie says she hasn't thought much about the future. A photo of the cattle ranch near Steamboat Springs, Colo., offers one clue. She and her husband plan to retire there one day. With no milking,

great views, and a three-hour drive to Boulder, it won't be hard to keep Jackie down on this farm.

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