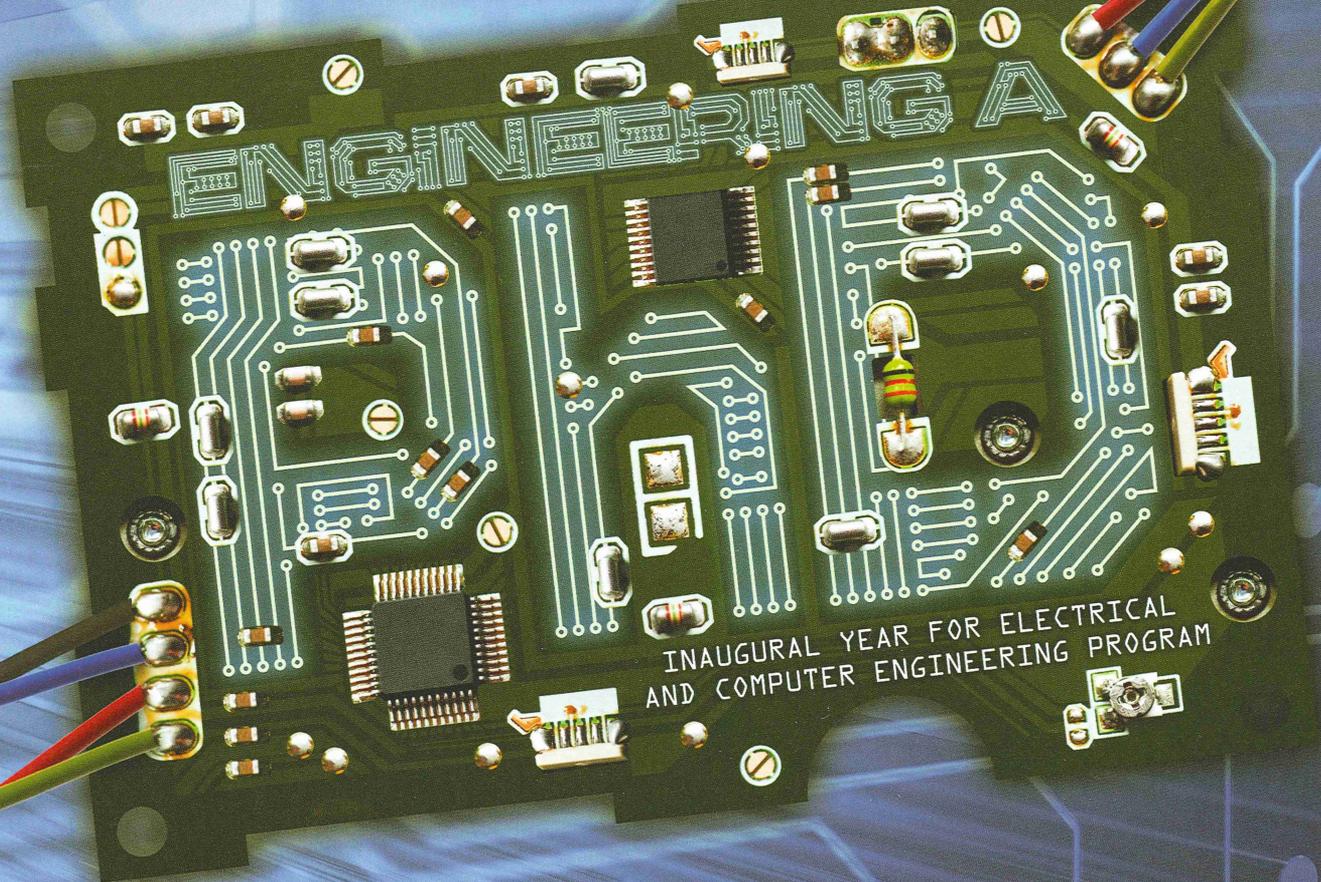


BAYLOR UNIVERSITY SCHOOL OF ENGINEERING & COMPUTER SCIENCE

# SYNERGY

SPRING 2011 VOL. 9



INAUGURAL YEAR FOR ELECTRICAL  
AND COMPUTER ENGINEERING PROGRAM



BAYLOR  
UNIVERSITY

ISSUE  
Spring 2011, Vol. 9

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**SYNERGY** 

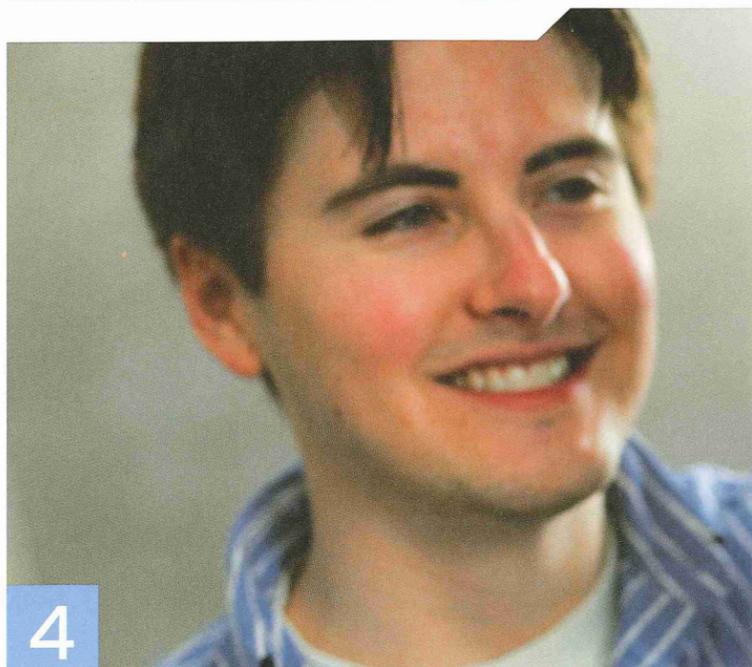
*Synergy* is a publication of the Baylor University School of Engineering & Computer Science that establishes a communication link to keep alumni and friends aware of the spirit of discovery at the School. Established in 1995 from programs dating to 1974, the School of Engineering & Computer Science has provided a quality education to more than 2,500 graduates in the tradition of excellence, a cornerstone of Baylor's heritage. *Synergy* is produced for the School of Engineering & Computer Science by Baylor's Division of Marketing & Communications.



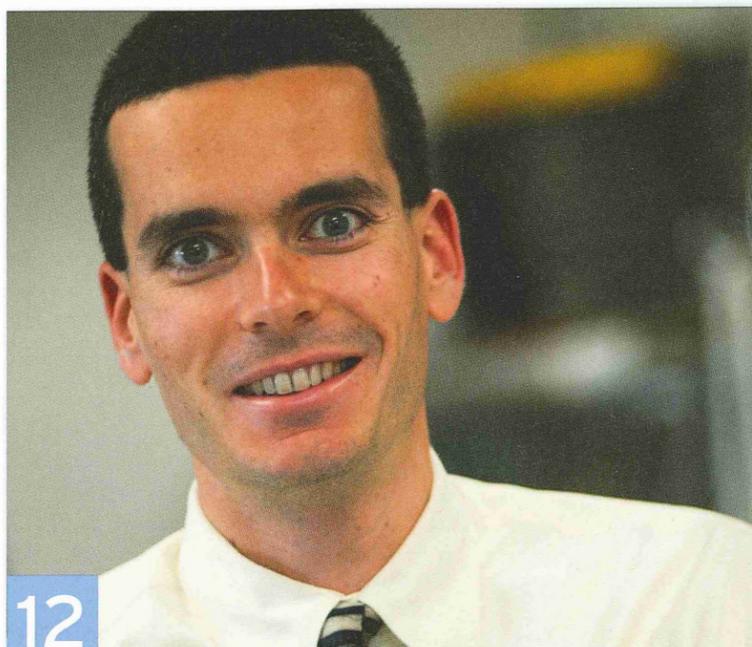
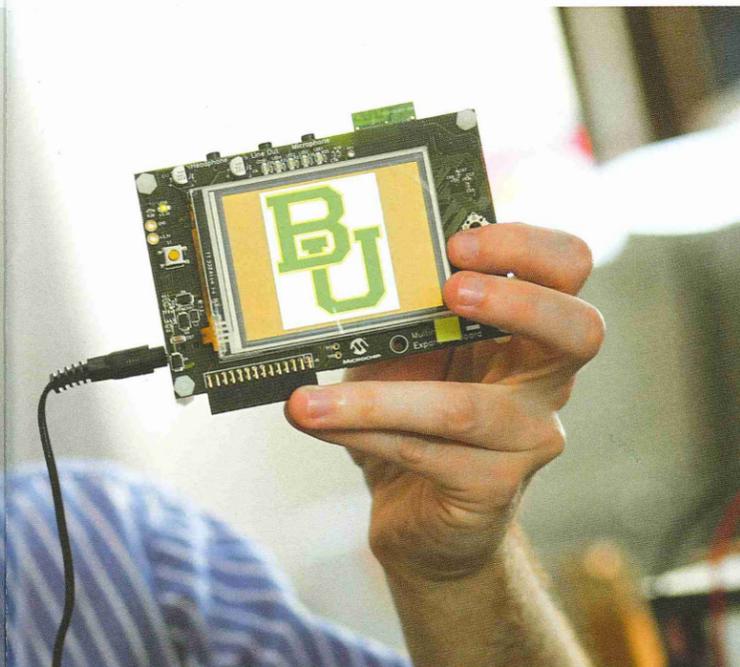
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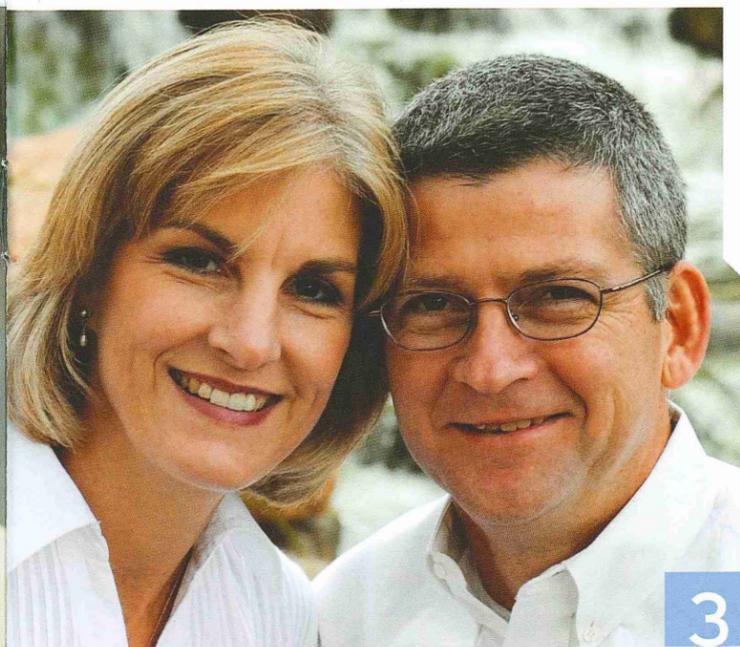
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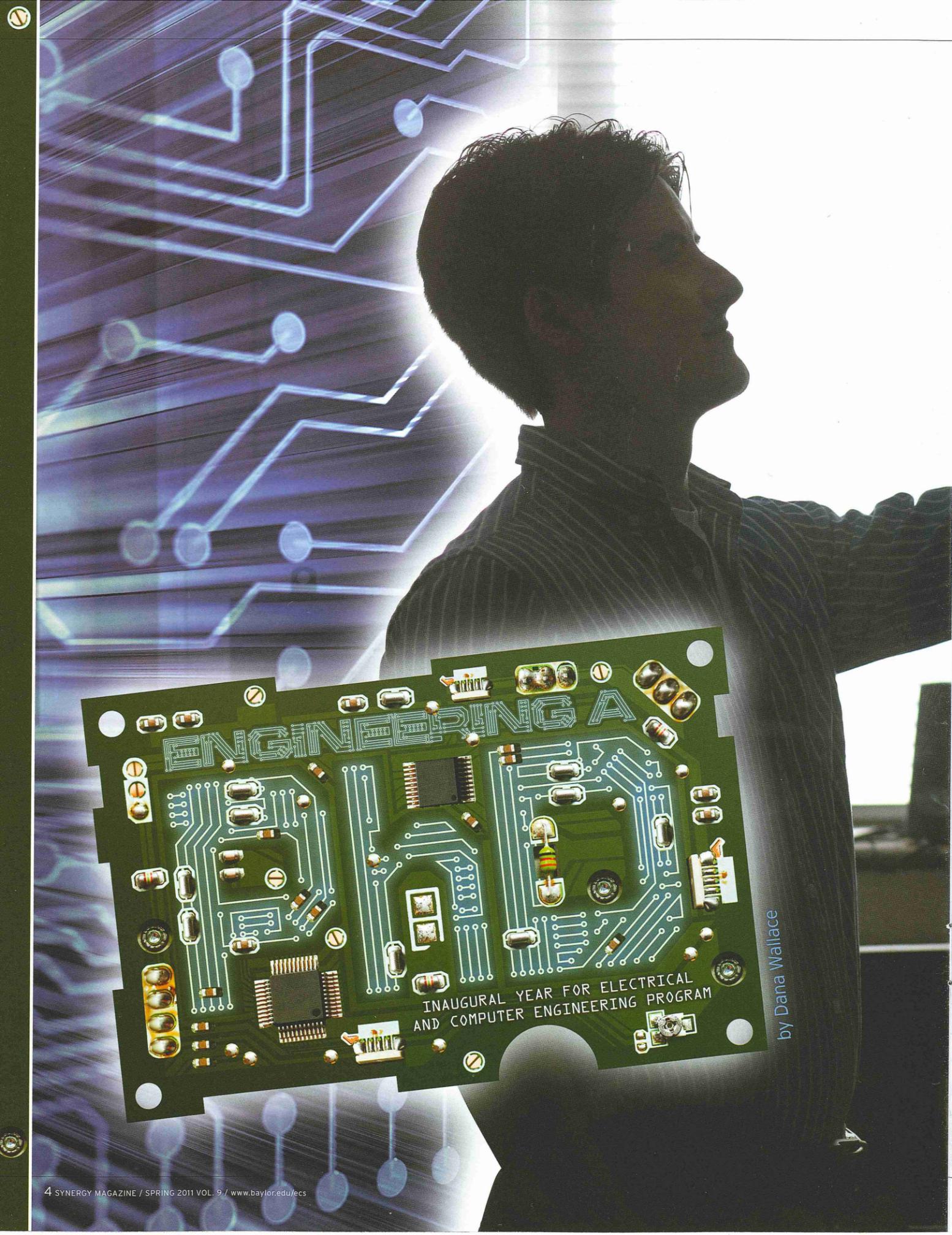
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## BRANDON HERRERA'S RESEARCH FOCUSES ON THE PROPERTIES OF CEMENT. HIS WORK, HOWEVER, IS ANYTHING BUT CONCRETE.

**"THE INDUSTRY DOESN'T HAVE A METHOD OF DETERMINING HOW THEY'VE MIXED THINGS.** You've got cement trucks, and they've got hundreds of thousands of tons on a construction project. It's all guesswork," says Herrera, whose research involves ultra-wideband measurement systems, or measurements taken via an electronic pulse.

He predicts the industry could prevent \$56 billion annually in wasted cement with a more accurate system for calculating the strength and performance of concrete.

Herrera is one in a handful of students enrolled in the Baylor School of Engineering and Computer Science's new Electrical and Computer Engineering PhD program, a first for the school. He's formed strong partnerships with his professors and classmates, and he's passionate about his research. These are just a few of the reasons he continued on at Baylor after completing his master's in electrical and computer engineering.

Getting a PhD program together has been no easy task. "Identifying research focus areas, developing new courses and a new curriculum and securing research space and equipment are among the greatest challenges in launching a new PhD program," says Dr. Benjamin Kelley, Dean of the School of Engineering and Computer Science.

The research-based PhD program has two major areas of emphasis. The first is power and energy systems, which supplements human abilities and aids in physical well-being. This technology is related to health care, air transportation, energy production and national security. The second is complex and adaptive systems, which includes energy storage, power conversion and green energy systems. Both programs allow for collaboration among departments within the school.

Currently ranked No. 11 among universities with the "Best Undergraduate Engineering Programs" by *U.S. News & World Report*, Kelley says his dream is for Baylor ECS to prosper and grow and that establishing PhD programs are both a result of current and future success.

Regents approved the program in February 2010, which means more time for targeted student recruiting for the program's second year. Dr. Mike Thompson, Director of Graduate Programs for the Department of Electrical and Computer Engineering, says there's

already been "considerable interest" in the program, which requires students to complete 60 credits beyond their bachelor's degree.

In order "to turn the corner on research, you need graduate students who are around for some length of time like PhD students are," says Thompson. "By the time you get a master's student graduated, they know a lot, but then they're gone. It's hard to push a research agenda without having PhD programs." In order to grow the program, the department plans to hire 10 new faculty over the next 5 to 10 years, nearly doubling its size.

Thompson and other faculty members such as Drs. Steven Eisenbarth and Kwang Lee contributed to writing the PhD proposal and shaping the program, which included researching peer models at Rice, Duke and Notre Dame.

### INTERDISCIPLINARY APPROACH

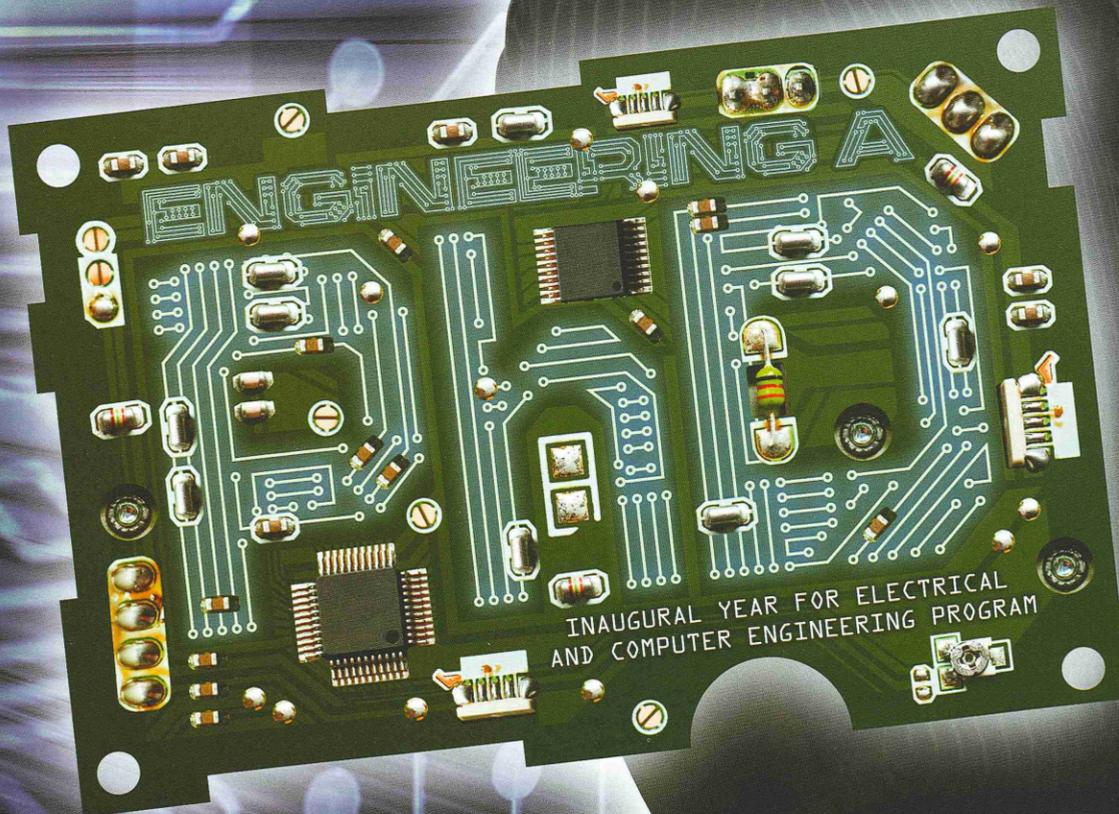
Winston Ewert has developed a healthy appetite for studying search algorithms through the No Free Lunch Theorem. "If you're using the computer to find something, and you don't know anything about what you're trying to find, then it doesn't matter what strategy you use. All strategies will work equally well," says Ewert.

He gives the example of a deck of cards lying face down on the table. There is no best strategy for finding the queen of spades because it could equally be anywhere in the deck.

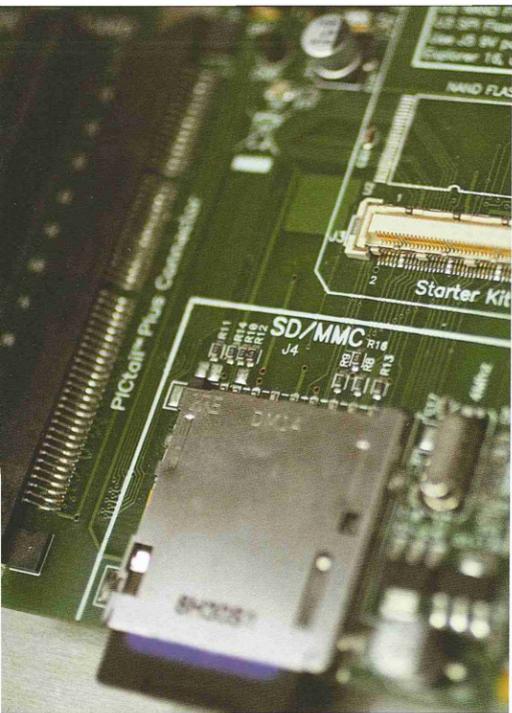
The reason researchers can do useful searches is because they know something about the space they're searching and are able to exploit that knowledge, according to Ewert. That in turn allows searches to succeed either more quickly or with better results. "You try to look for a solution that works in your particular problem," he adds.

**"You try to look for a solution that works in your particular problem."**

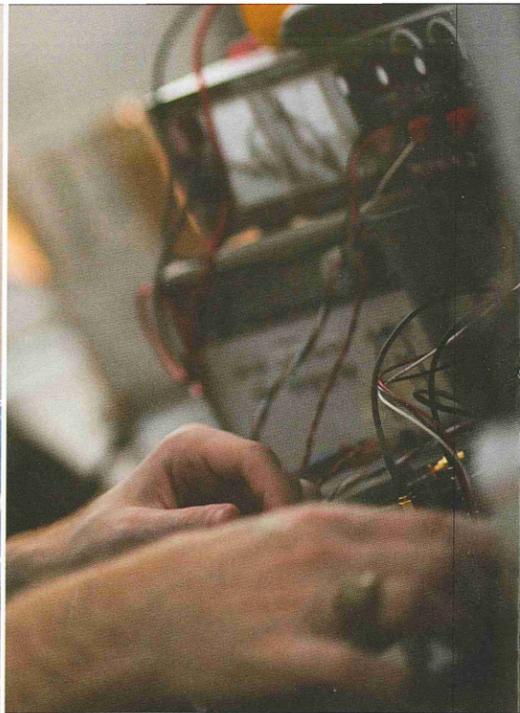
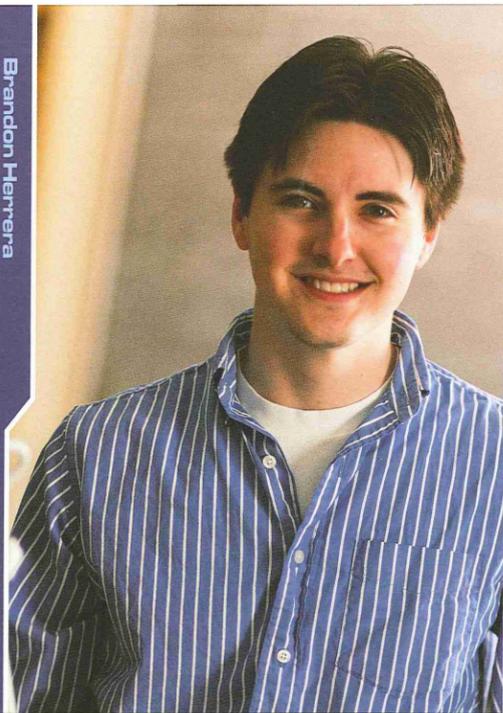
Ewert is a product of Baylor's computer science master's program and has joined the electrical and computer engineering PhD program, where his research is housed. "Both of the fields have a somewhat wide area of subfields in them, and they touch somewhere in the middle," says Ewert. "That's where I work."



by Dana Wallace



Brandon Herrera



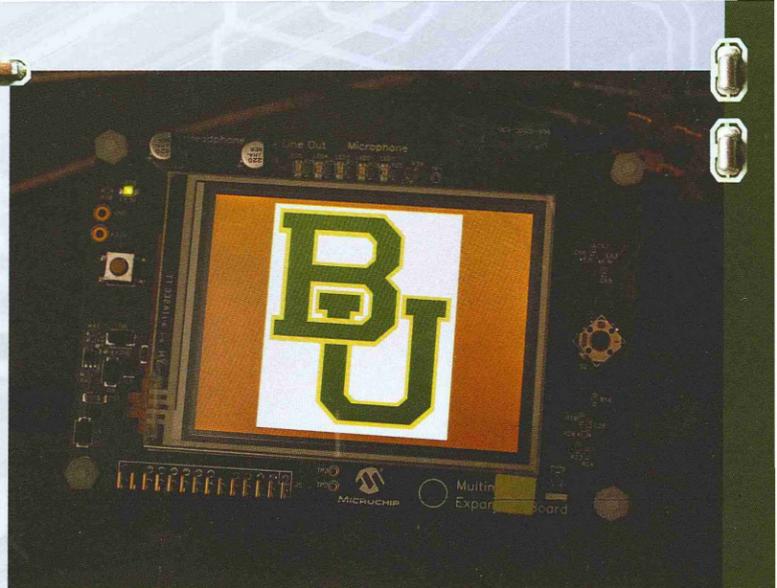
Expect a future filled with “new opportunities to grow those faith and research influences that will provide benefits to Baylor and the world beyond.”

**THE FUTURE**

The School has seen an increase in demand to enroll larger classes with better prepared students. “We are crossing an enrollment in the 800s on our way to 1,200-1,400 students,” says Kelley, adding that more PhD programs are also on the horizon. Expect a future filled with “new opportunities to grow those faith and research influences that will provide benefits to Baylor and the world beyond.”

With the addition of the most recent PhD program comes more faculty, which in turn adds the possibility of more electives. Thompson predicts that courses for students to specialize in - such as wind energy or power systems - will be added.

Baylor is also strengthening itself as a leading research university. “One of the areas Baylor comes up short when you look at comparing research schools is funded research,” says



Thompson, who believes that more and more external money from both government and industry will soon follow. “By increasing the emphasis on a fundable area, you naturally draw more research dollars toward Baylor.”

A high expectation has been set. “Baylor is investing a lot, so we’re going to try to perform,” says Herrera. “There is a large responsibility as Baylor moves toward ... a higher level of research in the sciences.”

The nature of work that’s never been done before is challenging. “You don’t know how you’re going to get the job done that day ... and so you keep trying. It’s creativity and ingenuity and a lot of luck and trial and error,” says Herrera, eagerly looking to the future of what his research in engineering at Baylor holds. “This stuff is hard, and we can accomplish it here.”

The interdisciplinary nature of his research makes him a great fit for the PhD program.

His work is theoretical; there will be no product that is born as a result. “It’s something that’s going on behind the scenes in many products you would be using,” says Ewert, who believes that being part of the inaugural class works in his favor by offering more flexibility with the program.

Also taking part in interdisciplinary work is Dr. David Jack, Assistant Professor of Mechanical Engineering. Jack has several areas of research that focus on carbon nanotube thin film conductivity. “The Air Force conceives of using this type of material for lightning strike protection for military aircraft,” says Jack.

Most aerospace applications with composite structures rely on a polymeric matrix, something that acts as an electrical insulator. The catch is that it burns or melts if struck by lightning. To solve that problem, copper mesh is typically placed around an aircraft. The drawback: It weighs a lot and is visible on radar.

The mechanical side of his work focuses on the structural and thermal modeling of composite materials. Jack believes that having a doctoral program in electrical and computer engineering will greatly enhance the understanding of the electrical component of his research. “I can have [mechanical engineering] graduate students enter the PhD program,” Jack says, excited about the prospect for additional programs. It demonstrates to the world, “Hey, look out. We’re Baylor.”

**OPPORTUNITY TO PARTNER WITH INDUSTRY**

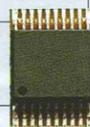
Baylor has joined forces with several area government bodies and organizations and will soon open the Central Texas Technology and Research Park at the former General Tire facility in Waco. The Baylor Research and Innovation Collaborative (BRIC) will be the first tenant located in the facility and provides graduate research space for the School of Engineering and Computer Science. In total, the facility has more than 300,000 square feet of space, with the ultimate goal of research and industry being located under the same roof.

“That’s the big idea,” says Herrera. “You have master’s or PhD students and through their work, they’ll invent something or have new technology. If it’s really good, you could just spin off a company right there.”

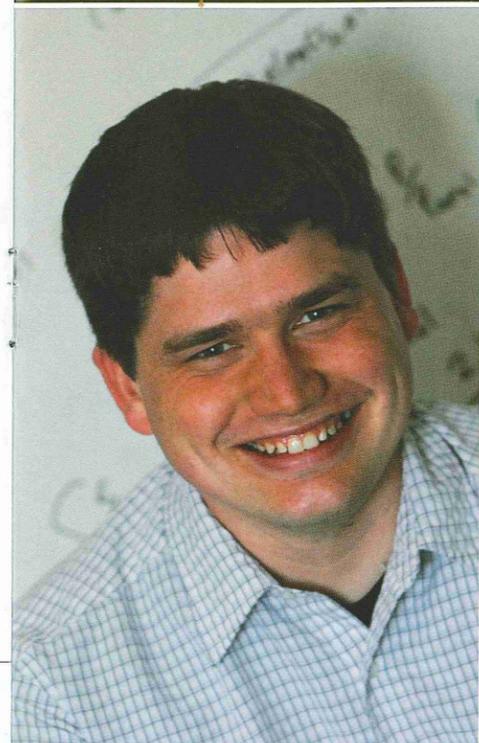
According to Thompson, with the research taking place through the BRIC, it will be easier to convince commercial tenants to locate there as well. “The BRIC should be able to help bring some ideas that the university can generate and transfer those into commercial products that help the economy in Texas,” says Thompson.

“Innovation doesn’t happen by accident,” adds Dean Kelley of Baylor’s increasing role in technological progress. “Creating an environment where students and faculty have the resources they need to pursue meaningful new engineering and computing advances is leading toward ever-increasing important technological innovations.”

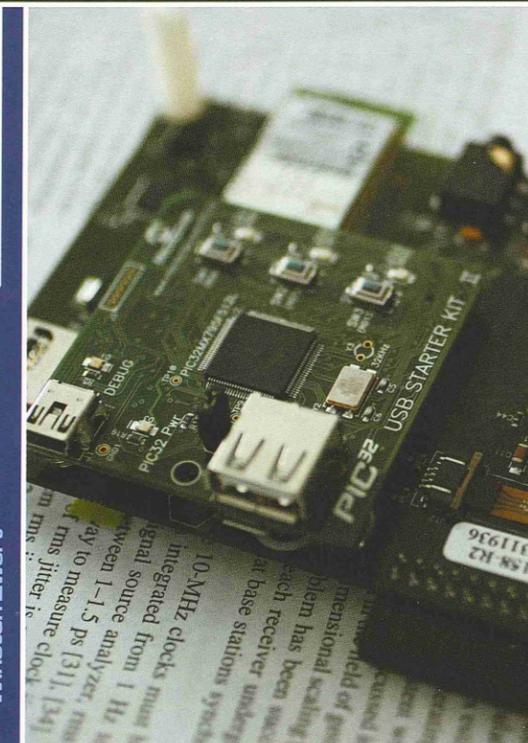
“The nature of research is you don’t really know where you’re going.”



That’s where Jack’s work comes in. He’s searching for a lightweight material that can handle the electrical current and has been chipping away at the problem a little at a time. “The nature of research is you don’t really know where you’re going,” says Jack.



Winston Ewert



Dr. David Jack

