A young girl with brown hair, wearing a red t-shirt and dark pants, stands in a vast field of tall, dry grass. She is holding a tablet computer in her left hand, which displays a sunset scene. In her right hand, she holds a flashlight that is turned on, casting a bright light. The background shows a horizon line under a twilight sky with soft clouds.

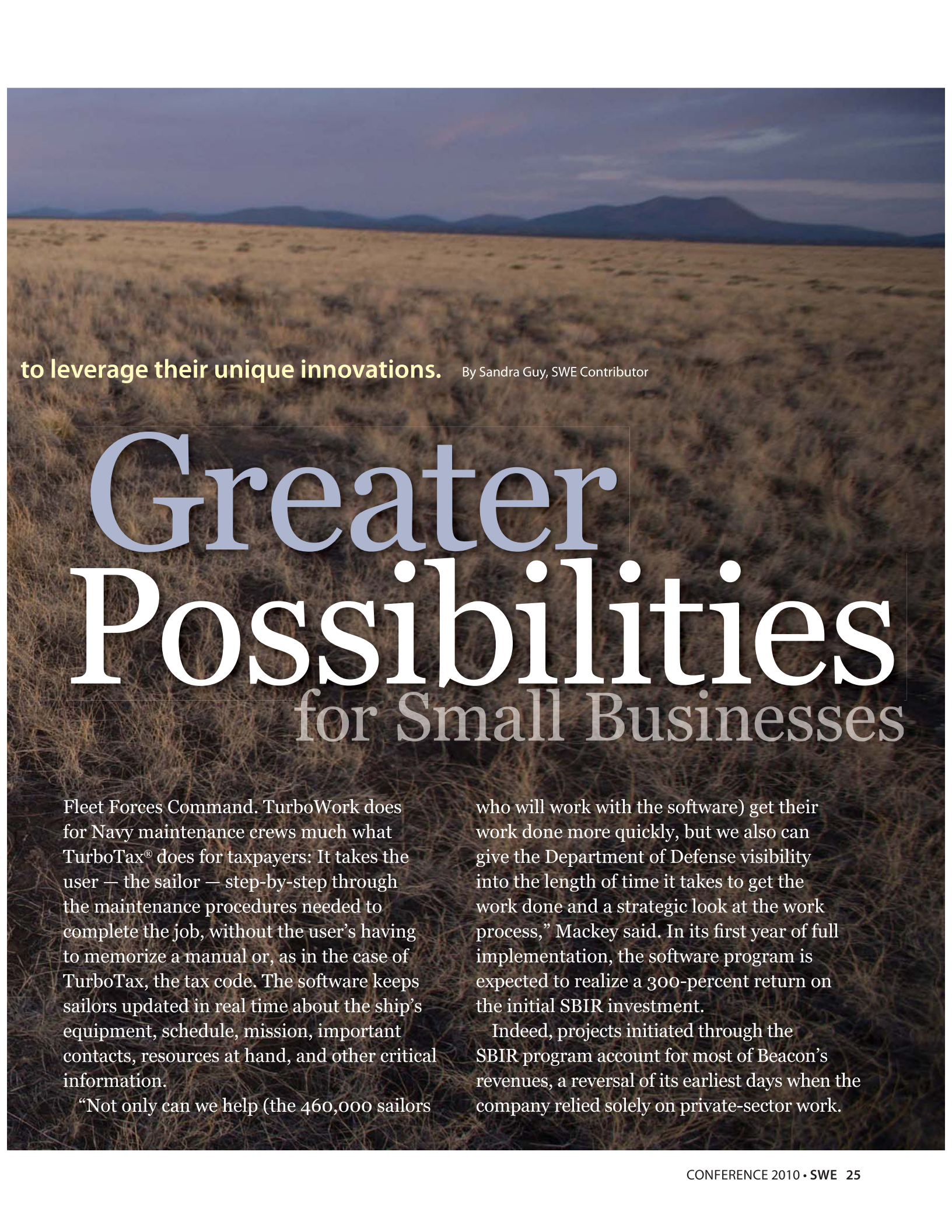
## Federal program provides opportunity for small technology companies

**M**.L. Mackey credits the federal government's Small Business Innovation Research (SBIR) Program with saving her software company when the 2000-2001 recession hit companies like hers particularly hard. "We were the small guy who had beaten the big guys as a way of life, but in the year 2000, the big guys started swimming downstream into our business opportunities. Everything collapsed on us," she said.

Mackey, an electrical engineer who co-founded Beacon Interactive Systems with

her husband, Mike MacEwen, on April 1, 1994, learned about the SBIR's program hosted by the U.S. Department of Defense (DoD). "One day, we got a call from a former employee who had been reading through an SBIR application, and thought some of the topics sounded very much like Beacon's core expertise," Mackey said. "Up to that point, we had never heard of the SBIR Program, let alone thought of becoming a federal contractor."

The result? The Navy is deploying Beacon's TurboWork™ software to every ship in U.S.



to leverage their unique innovations. By Sandra Guy, SWE Contributor

# Greater Possibilities for Small Businesses

Fleet Forces Command. TurboWork does for Navy maintenance crews much what TurboTax® does for taxpayers: It takes the user — the sailor — step-by-step through the maintenance procedures needed to complete the job, without the user's having to memorize a manual or, as in the case of TurboTax, the tax code. The software keeps sailors updated in real time about the ship's equipment, schedule, mission, important contacts, resources at hand, and other critical information.

“Not only can we help (the 460,000 sailors

who will work with the software) get their work done more quickly, but we also can give the Department of Defense visibility into the length of time it takes to get the work done and a strategic look at the work process,” Mackey said. In its first year of full implementation, the software program is expected to realize a 300-percent return on the initial SBIR investment.

Indeed, projects initiated through the SBIR program account for most of Beacon's revenues, a reversal of its earliest days when the company relied solely on private-sector work.

Mackey and MacEwen named their company after Beacon Street in Boston, the location of their rent-controlled apartment where they started out. Beacon Interactive Systems is one of 18 vendors involved in ensuring that the integrated maintenance software program sets sail smoothly. Said Mackey of the SBIR opportunity, “SBIR encourages small companies to develop their capabilities as well as their products.” Even more, SBIR offers small businesses the opportunity to do what they do best, Mackey said: leverage their quick-footedness, ethnic and gender diversity, and unique ways of thinking to offer the kinds of innovations that a large bureaucracy needs.

**How the process works**

The federal government sets aside 2.5 percent of its research-and-development spending for the SBIR program. The amount totaled \$2.5 billion in fiscal 2009, a 39 percent increase from \$1.8 billion in 2005. “The total has been increasing as federal research dollars have increased,” said Sean Greene, associate administrator for investment and a special advisor for innovation for the program.

Eleven government agencies participate in doling out SBIR funds based upon each agency’s mission.



**M.L. Mackey co-founded Beacon Interactive Systems.**

Participants include the DoD, the Department of Energy, the National Science Foundation, and the National Institutes of Health. Companies respond to each agency’s request for ideas for pressing research-and-development needs, such as developing alternative energy, uncovering the causes of specific diseases, or inventing new kinds of robotics used in unmanned military vehicles.

Each agency chooses the ideas with the greatest potential, and awards Phase I grants or contracts up to \$150,000. (The maximum \$150,000 is a recent increase from the previous \$100,000 maximum.) The agencies evaluate the proposals based on technical merit, the firm’s qualifications, and the commercial potential and/or societal benefit of the proposal.

According to a June 2009 SBIR report, the latest data showed the share of women-owned firms receiving Phase I grants grew to 11 percent in 2004-2005, up from 6.5 percent in 1998.

Essentially, under this program the federal government acts as a seed-stage investor, except that it

takes no equity from the company in which it is investing. The company retains rights to its own patents.

About half of the grant and contract recipients go on to receive Phase II funding, which can reach \$1 million per winning company. (The \$1 million is a recent increase from \$750,000.) About half of the recipients succeed in getting their products to market, and 25 percent of *R&D Magazine’s* awards for the top 100 innovations come from SBIR-funded small businesses, according to the SBIR study.

Only Phase I recipients may be considered for Phase II grants. Phase I supports the design of a solution while Phase II allows for prototype development. SBIR provides no funding for Phase III — commercialization — leaving companies to find their own funding to move their technologies into the private marketplace.

The process between offering initial proposals and winning Phase I and Phase II funding can be excruciating, concedes Mackey, who earned her B.S. in electrical engineering from Lehigh University in Bethlehem, Pa. Yet, she said the federal government desperately needs the kinds of cost-savings and commercial-sector expertise that small businesses, and particularly women-owned businesses, can offer.

Furthermore, the SBIR Program provides a structured and funded insertion point by which small businesses can engage in new industry sectors, Mackey said. By participating in the Navy SBIR Program, Beacon was not only able to navigate into the DoD marketplace, but it also was able to maintain and subsequently increase its work force and strategic intellectual property. “By participating in the SBIR Program, the company is better poised today to support both its public and private-sector clients,” Mackey said.

**Scrutiny and need for renewal**

Alison Brown, Ph.D., founder, president, and CEO of NAVSYS Corp., credits her company’s SBIR projects over the past 20 years with helping NAVSYS develop outstanding products in its Global Positioning System (GPS) technology niche, and with helping provide a solid revenue stream. “The good news is that you can do some extremely creative things,” said Dr. Brown. A native of Edinburgh, Scotland, she received an engineering scholarship from the Massachusetts Institute of Technology (MIT), which brought her to the United States.

Dr. Brown pursued her engineering career despite her father’s objections. An electrical engineer who worked with inertial navigation systems, he was convinced that his daughter would experience a tough time in engineering, given the prejudice against women that he had witnessed. Fortunately, Dr. Brown’s decision proved to be fortuitous. Her resume glows with the type of engineering and technical background that any business or government agency would covet. She holds a Ph.D. in

mechanics, aerospace, and nuclear engineering from UCLA; an M.S. in aeronautics and astronautics from MIT; and an M.A. and a bachelor's degree in engineering from Cambridge University. She is an Honorary Fellow of Sidney Sussex College, an Institute of Navigation Fellow, and has served twice on the Air Force Scientific Advisory Board.

Her business success with SBIR is equally impressive. NAVSYS developed the TIDGET™, a tracking widget that solved the problem of GPS receivers being slow to power up. The TIDGET did so instantaneously and used



**Alison Brown, Ph.D., is founder, president, and CEO of NAVSYS Corp.**

extremely low power in order to capture a picture of raw satellite signals, much like a tape recorder capturing a voice.

A 40-employee company based in Colorado Springs, Colo., NAVSYS commercialized the technology to enable cell phones to signal the user's location to 911 responders, a capability that is now a national mandate. NAVSYS also developed key technology components of the Wide

Area Augmentation System, which enabled the Federal Aviation Administration to use geostationary satellites to augment GPS. The technology turns a geostationary satellite into a "lookalike" GPS satellite and is used to provide better accuracy and high-integrity GPS services for civil navigation applications.

About half of NAVSYS' \$7 million annual revenues come from SBIR contracts. Yet Dr. Brown has become disheartened that small businesses don't have adequate protection to ensure that they hold on to their intellectual property, especially in the DoD and Air Force Space Command programs. She pointed to previous experiences where large, prime government contractors have taken over the most promising intellectual property from SBIR award winners, without further involving the small businesses. Dr. Brown's concerns have prompted the Senate Armed Services Committee's Subcommittee on Strategic Forces to initiate an investigation by the Government Accountability Office into barriers to new entrants in the Air Force Space Command program.

Despite these concerns, Dr. Brown continues to encourage women-owned businesses to seek SBIR

awards because she believes the competitive process is fair and a good opportunity. "Recognize that winning an SBIR is only the first challenge," she said. "Transitioning SBIR into a product and a sustaining business model is very difficult."

A GAO spokesman said the report on possible small-business barriers, scheduled for an Oct. 18 release, analyzes SBIR contract data and examples of successful SBIR efforts to transition technologies. In addition, the GAO will interview DoD and other agency officials, as well as representatives of small businesses, to talk about examples of other initiatives that could engage small businesses in space-systems acquisitions.

Critics also point to research by the Innovation Development Institute, a Swampscott, Mass.-based research firm, indicating that out of the 5,800 businesses that received SBIR awards in 2009, only 560 were less than 4 years old. This is a significant decline from 952 out of 3,306, the data from 2003. The Institute keeps the most comprehensive database available of the 19,000 companies granted SBIR funding — an amount totaling \$30 billion — since the initial program started in 1982. The database includes the SBIR-funded companies' patents, citations, employment, venture funding, mergers and acquisitions, licensing agreements, and awards and recognitions.

Ann Eskesen, founding president of the Institute, said the SBIR application process has become so complicated that fewer start-up companies are able to obtain the funding "to open the door for the first time." Eskesen was a technology transfer specialist instrumental in creating the SBIR program. She is a nationally known consultant who advises businesses about the program.

Yet Eskesen said that beyond the application process, the real problem is that the SBIR isn't connecting its small-business award winners with large companies and institutions that desperately need the small-business



*SBIR offers small businesses the opportunity to do what they do best: leverage their quick-footedness, ethnic and gender diversity, and unique ways of thinking to offer the kinds of innovations that a large bureaucracy needs.*

innovations. "We (the SBIR) are not doing anything on a systematic basis to draw down the value of what we have created," Eskesen said.

The issue reflects the changing nature of the U.S. economy, she said, because major corporations that jettisoned their research-and-development divisions as too costly in the 1990s are now seeking to buy innovation by acquiring small companies with emerging

and disruptive technologies. “Nearly 8 percent of SBIR companies have been bought, mostly by large corporations,” Eskesen said.

Furthermore, she added, three times more engineers and scientists with graduate degrees work for SBIR-funded companies than for academic institutions. “The SBIR is the single largest concentration of research-and-development endeavor anywhere,” Eskesen said. “Now, we’ve got a serious situation when every SBIR-funded company is individually responsible for planning and then raising the dollars to move their technologies from Phase II to Phase III.”

The stakes are so high that SBIR’s congressional reauthorization became bogged down in a debate about whether to include it in any upcoming small-business job creation legislation that may be considered. As of Sept. 22, Congress had extended the SBIR Program “as is” through Sept. 30.

### Reaching out in new ways

So how should small companies that create new technologies protect their intellectual property while

program will award a total of \$2 million (up to \$100,000 per applicant), with an emphasis on helping socially and economically disadvantaged firms compete in the SBIR process. Applicants for FAST funding are encouraged to show how they help support small business research and development, technology transfer from universities to small businesses, and proposal development and mentoring for the small businesses that apply for SBIR grants.

### Mentors, role models, and advice

Indeed, mentoring plays a major role in developing influential women who can lead small businesses specializing in science, technology, math, and engineering. Mackey encourages girls to understand that their skills hold potential for terrific creativity, great leadership, and business smarts. “I often look back and say, ‘How would I know that I would be a good engineer based on what I did as a kid?’” Mackey said.

She realized that her passions for sewing and cooking mirrored an engineer’s skills: seeking a solution to a problem, considering a number of ways to reach the goal, assembling the necessary materials, following instructions, and realizing a solution.

Yet Mackey seized upon the fact that, due to social mores, she was explicitly encouraged to pursue her passion for ballet but not her interests in mathematics and science. Motivated by a strong desire to be financially independent, she pursued electrical engineering anyway and, upon her college graduation, landed the highest-paying job of her entire class. That was despite her mediocre grades due to working her way through school in fast-food joints, retail stores, and work-study programs.

Mackey credits her mentor, Ruth Allen, a valued technology executive, with helping her develop her professional skills and abilities. While running a national technical user group for IBM Corp., Allen hired Beacon to develop an interactive website for her group.

The professional chemistry between the two women was such that when that engagement ended, Mackey and Allen continued working together. “If you can find a mentor who is truly vested in your development and interested in sharing what they’ve learned, you have something invaluable,” Mackey said.

Mackey advises potential entrepreneurs that it is critical to understand how to succeed in a competitive marketplace. “Make sure you stay true to what you like to do and what you’re good at, because it will be a lot of hard work,” she said. “Learn how to sell. If you can’t communicate with your customers, you have nothing. And you must keep in mind the specific tactical steps needed to develop a business while finding successful solutions for customers.” ■



*The federal government desperately needs the kinds of cost-savings and commercial-sector expertise that small businesses, and particularly women-owned businesses, can offer.*

providing the greater economy with jobs and critically needed expertise? The Innovation Development Institute runs an ASSET system: Access SBIR-STTR (Small Business Technology Transfer Research, often paired with SBIR) Scientific and Engineering Talent system. The system helps large- and mid-size companies to start working relationships with SBIR-STTR awardees.

A handful of universities nationwide also are actively seeking investors and businesses that could develop and commercialize professors’ promising technologies, according to a June 25 article in *The New York Times*. Unlike business incubators, these “proof-of-concept centers” are commercializing university research in much faster time than traditional technology transfer offices can, according to the *Times* article.

Separately, the government is trying to expand SBIR’s visibility by awarding competitive grants to regional and state-level organizations dedicated to helping entrepreneurs. The program, called FAST, for Federal and State Technology Partnership Program, calls for the U.S. Small Business Administration to accept funding requests from state governors. The