

Delores M. Etter

Unexpected Paths

As a high school student in a small rural Oklahoma town, the most exciting thing I could image was going to college at Oklahoma State University (OSU). The path that started in the oil fields and prairies of Oklahoma has led me down branches of life that I would never have expected. I never expected to be an engineer, and I never expected to land on an aircraft carrier, spend a day on an attack submarine, or ride in an F-15. And I certainly never expected to have an office down the hall from the Secretary of Defense and to be responsible for a US\$9 billion science and technology budget.

The path from home did initially lead to OSU. I was married between my sophomore and junior years at OSU. Within a year, my husband joined the Air Force (it was 1967, the height of the Vietnam War), and our path was determined by the Air Force for the next few years, first to Dayton, Ohio, at Wright Patterson Air Force Base, and then to Albuquerque, New Mexico, at Kirtland Air Force Base. I finished my B.S. degree at Wright State University and also got a M.S. degree there, both in mathematics with all the computer science courses I could find. My Ph.D. work in electrical engineering was done at the University of New Mexico (UNM), and I joined the EECE faculty there in 1979. After ten years on the faculty at UNM, I accepted a position at the University of Colorado (CU) in Boulder. (My daughter, already a stu-

dent at Colorado State University, was convinced that we were following her.) After eight years at CU, I had an opportunity to take a position in the Pentagon as the Deputy Under Secretary of Defense for Science and Technology. I was there for a little over three years, leaving just six weeks before 9/11. I had planned to return to CU, but we decided to stay in the Washington, DC, area, and I accepted a faculty position in the Electrical Engineering Department at the United States Naval Academy in Annapolis, Maryland.

But I have skipped over some important milestones in my career, milestones that helped shape my career and helped me form guidelines that still help me make decisions today. I am listing here five of these guidelines that may prove helpful to new faculty or new engineers just starting a career.

Guideline 1 **Keep Your Head Low Until You Get Tenure**

This guideline is of course aimed for academics, but it can be useful to anyone early in a career. You must stay focused until you are able to establish a track record, and then you will have more flexibility in work choices. For academics, it is especially important to avoid excessive committee assignments and service commitments until tenure is behind you. Also avoid administrative assignments as much as possible during this time. Many universities today make strong statements about the equivalence of excellence in research and excellence

The first article of this new sequence of special columns, which appeared in the March issue of *IEEE Signal Processing Magazine*, was written by a College of Engineering dean. For this issue I have invited individuals who have both been in high-level government and academic positions to share their thoughts and insights from their experience. Delores Etter provides helpful guidelines for successfully shaping up the careers of researchers through many examples from her own life. Allan Steinhardt discusses the subject of bringing basic research to a useful product, as well as related challenges for academia, industries, and government, and suggestions for solutions. I encourage you to read these articles, as they are very interesting and can greatly benefit many of you as individuals and also our society as a whole. Future columns include authors from industry and other backgrounds.

—Arye Nehorai

(Arye Nehorai is with the University of Illinois at Chicago, where he was named University Scholar. He has held several positions within the IEEE Signal Processing Society and is currently vice president, publications. He was editor-in-chief of IEEE Transactions on Signal Processing.)

in teaching, but in reality, very few really stand behind that when making tenure decisions. Before tenure, you must focus more on research than teaching; after tenure, you will have opportunities to move the pendulum in the other direction if you want.

Guideline 2
Take Interesting Opportunities When They Come Along

Interesting opportunities are bound to come up over the years as you become active within your research community and as you become more involved with professional activities. Many of these opportunities won't come up again, so you won't have a second chance. Interesting opportunities often occur because you have worked hard to make them happen; they are seldom just luck and good fortune. Three important opportunities come to mind that were significant for me.

The first was an opportunity to spend a year at Stanford University as a visiting professor through an NSF program. The colleges that I had attended to get my degrees (OSU, the University of Texas at Arlington, Wright State University, and UNM) had been determined initially by where I grew up and then later by the fact that my husband was an officer in the Air Force. The opportunity to spend a year at Stanford seemed like a dream come true.

The second opportunity was one that led to my involvement for many years in the leadership of the IEEE Signal Processing Society. As I began presenting research papers and attending conferences, I was disappointed that there were no women or representatives from west of the Mississippi River on the governing board for our Society. At first I just complained, but then decided that I should run for office myself. I was relatively unknown to Society members, but I was able to get a mailing list of the California members; this was the

year I was at Stanford. I sent a letter to these California members and urged them to vote for me so that the Western United States would have representation. It worked!

The third opportunity came "out of the blue." In 1989 I got a call from the Air Force Studies Board in Washington, DC, asking me to be a member of a committee that was going to look at tactical communications. I asked my department chair at UNM if he had heard of the Air Force Studies Board, and he said, "Yes—do this!" Work with this committee opened up a world that was to become increasingly important to me, as I will describe later.

Guideline 3
Focus on Things You Enjoy and That Have Significant Impact

In any profession, there will be more things that you want to do than are possible. I think this is especially the case in academics because we are encouraged to be active in research, in teaching, and in service. Trying to be good at too many things takes much of the enjoyment out of them, so you have to make choices. This is as true later in your career as it is earlier. You can't be a successful champion for many causes. Pick a small number of things that you enjoy and that you think are significant, and be passionate in your commitment to them. These choices should be based on where you can make a difference and may not always be the ones that your chair prefers, as you will see in my two examples (this is another reason for following Guideline 1 initially).

In 1981 I decided to write a freshman engineering text on problem solving using FORTRAN. I had been teaching computing for several semesters and found that all the textbooks were very general and did not include realistic engineering problems. I was confident that I could do this and quickly found a publisher. My department chair told me that it

would be a mistake to write a textbook (especially a freshmen text!) at that point in my career. I persisted anyway, and that FORTRAN book became the best-selling textbook nationwide (actually, internationally) for engineering computing for a number of years. I always enjoyed showing my former chair the sales numbers for my books as I continued to write introductory textbooks.

My work on the Air Force Study Board's Tactical Communication Committee led to being asked to join the Naval Research Advisory Committee (NRAC). I spent seven years on the committee and chaired it for two of those years. These activities took several days each semester, and then most of my summers, as I learned more about the Navy and its use of technology. I visited naval and marine bases around the world and saw firsthand most of the systems and platforms that the Navy uses, from carriers, to helicopters, to harriers, to submarines, to hovercraft. These experiences made me a better teacher in many ways because of the ties to the real world that I could take back to my classes. The NRAC experience led to being asked to join the Defense Science Board, the board that advises the Secretary of Defense on technical issues. However, these service activities did not lead to research publications or consulting contracts, and my chair at CU questioned the value of spending so much time on these activities. But it was these activities, and the networks of people that I was interacting with through these activities, that would open up new adventures for me later.

Guideline 4
Trust Your Instincts

Our instincts, or "gut feelings," are the result of our life experiences and our value systems. I think that instinct is just another term for wisdom, and thus our instincts get better as we get older. We also learn a lot from our

mistakes, perhaps even more than we learn from the things we do correctly. These instincts are almost always right, and you must learn to trust them. When something just doesn't feel right, don't ignore that feeling.

In my position as Deputy Under Secretary of Defense for Science and Technology, I often found that I had to make decisions without all the information that I wanted. It became clear to me that this is what leadership is all about. When you have all the information that is needed to make a decision, it usually is very straightforward to make a good decision. Leadership is making decisions when you don't have all the information that you would like—when you have to trust your instincts.

Guideline 5
Take Responsibility for the Tone of the Environment Around You

I left this guideline for last because it is one that you have more control over later in your career. However, even as an assistant professor or beginning engineer, there are ways that you help establish the tone of your environment. I use the word "tone," but sometimes people use the word "climate." It is important to build inclusive programs and activities, and that means that they need to be done in environments where everyone involved is comfortable. As a woman in a field in which there are still few women, there have been times when I was uncomfortable because of things that people said or things that were in the environment around me. It can be difficult for students or relatively new faculty or engineers to speak up about these issues. When it is early in your career, I think you have to decide for yourself which ones are important enough to address and which ones can wait. For those of us who are more senior, however, we cannot ig-

nore this responsibility. We must speak up and take on these issues when we see them. We can't ignore the things that make our junior colleagues uncomfortable or that make our students uncomfortable. This is a serious responsibility and requires that we be proactive, not just reactive. We are role models and mentors, and we need to set standards of behavior and actions that clearly represent our values. I think that the hardest part of this for me is being ready to speak up when something is said in my classroom that is inappropriate. If I ignore it, or wait until later, the impact of my message is lost. During my first semester at CU, a student group used a very inappropriate example in a classroom presentation. The last thing I wanted to do as a new professor was to take issue with this example, and yet it had to be done, and it had to be done during that class so that all the students knew that it was a very inappropriate example.

It is also important to me that people use gender-neutral language. I don't feel included when discussions (oral or written) use only male pronouns when talking about general groups of students or engineers. I have had a number of women students tell me that they feel left out of discussions when professors constantly use pronouns such as "he" and "his" in their lectures. I have occasionally mentioned this to colleagues of mine, and they tell me that they are assuming that "he" really means anyone. It is clear that many students, and many women, including me, do not feel that way. I also know that using expressions like "he/she" can be awkward, but there are other simple solutions to this issue. Some people alternate gender terms in their writings; I prefer to use plural pronouns (such as "we," "they,") so that I avoid the gender issue.

I have now been at the Naval Academy for nearly two years. This has been a good career choice for me because it allows me to get back to academics, which has been where I have spent most of my career. Being at the Naval Academy also allows me to still stay involved in national defense, an area that I feel is critical, not only for our country, but also because the Department of Defense is a key player in supporting the research that sustains many university research activities and supports many of our graduate students. Being close to Washington, DC, also allows me to easily stay involved in advisory committees. For example, I am back on the Defense Science Board, and I participate in many of the activities of the National Academy of Engineering. And I still have Guideline 2 in the back of my mind: Take interesting opportunities when they come along



Delores M. Etter was a member of the electrical engineering/computer engineering (EECE) faculty at the University of New Mexico from 1979 to

1989 and the EECE Faculty at the University of Colorado from 1990 to 1998. From June 1998 through July 2001, she was the Deputy Under Secretary of Defense for Science and Technology. She is currently a member of the electrical engineering faculty at the United States Naval Academy and holds the ONR Distinguished Chair in Science and Technology. She is a former president of the IEEE Acoustics, Speech, and Signal Processing Society. She is also a member of the National Academy of Engineering.