Ask an Acoustician: D. Keith Wilson

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Meet D. Keith Wilson

In this issue, "Ask an Acoustician" features D. Keith Wilson, a research physical scientist at the US Army Engineer Research and Development Center Cold Regions Research and Engineering Laboratory (ERDC-CRREL) in Hanover, NH. Keith has been attending meetings of the Acoustical Society of America (ASA) since 1986. He has served as an editor for *The Journal of the Acoustical Society of America* (*JASA*) for the Noise Technical Committee and as chairperson of the ASA Committee on Publication Policy. With Allan Pierce (then editor in chief of *JASA*), Keith helped to launch *The Journal of the Acoustical Society of America-Express Letters*. Most recently, he worked with Amanda Hanford to start the new ASA Technical Specialty Group on Computational Acoustics. For examples of Keith's research, see the **Bibliography**. I will let Keith tell you the rest of his story.

A Conversation with D. Keith Wilson, in His Words

Tell us about your work.

Most of my research is in the area of atmospheric acoustics. The research ties together sound propagation physics, atmospheric turbulence, and computational methods. While working on my PhD at Pennsylvania State University (University Park), I was able to get a solid grounding in aspects of meteorology pertinent to the lower atmosphere. This multidisciplinary perspective has helped to inform my subsequent research. In particular, I'm interested in how the variability of the atmosphere across a variety of scales in time and space impacts sound propagation and limits predictability in a deterministic sense. An earlier *Acoustics Today* article (2015) provides more discussion on this topic. The variability and predictive challenges are an important consideration in noise regulation.

I have spent most my professional career working at government laboratories. Although I didn't envision a scientific career with the government, it has been rewarding to serve the public, and I am fortunate to have had the opportunity to work on many fascinating research problems. The Army is interested in atmospheric acoustics for a couple main reasons. First, there is the military problem of how far away something can be heard or detected with a sensor. Second, there is the problem of minimizing disturbances from noise produced by training and testing activities. The scientific issues underlying the two problems overlap. My own projects are a mixture of basic and applied research. The applied research projects often involve transitioning acoustical modeling capabilities, which come from basic research, into software and technology for soldiers. For applied research, I also get involved in modeling seismic, radio-frequency, optical, and even chemical and biological signals. Acoustics is great, but it is also fun to delve into other things.

Describe your career path.

I envisioned growing up to become a scientist for as long as I can remember, which is probably not surprising because my father was a chemistry professor at Kalamazoo College (MI). But I became an acoustician largely by chance. As an undergraduate, I resolved to major in anything *except* chemistry; because I found applied physics and electronics intriguing, physics won out. I received my BA in physics from Carleton College (Northfield, MN). Next, I went to the University of Minnesota (Minneapolis) to work on a master's degree in electrical engineering, where I focused on finding a research assistantship in areas such as optics and magnetics. I wasn't really thinking about acoustics.

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But Professor Robert F. Lambert, a prominent member of the ASA who was on the faculty there, had a position available for a project on the acoustics of porous media. The subject seemed interesting enough and helped to pay for rent and frozen pizzas. I only gradually started thinking of myself as an acoustician. Maybe it took hold because it was cool to learn about noise control and decibels. Maybe because it connected with my liking of music. Or maybe I just got hooked when I went to my first ASA meeting in 1986. In any case, I became interested enough in acoustics that I decided to attend the Penn State Graduate Program in Acoustics for my PhD. It was at Penn State where I really dove into atmospheric acoustics and the connections to meteorology, thanks in large part to my PhD advisor, Dennis W. Thomson, and later when I was a postdoc with John C. Wyngaard. After a year as a postdoctoral fellow at the Woods Hole Oceanographic Institution (MA), where I worked with George Frisk among many other outstanding acousticians, I returned to Penn State briefly as a research faculty member. I have been at ERDC-CRREL for about 17 years now and an Army researcher for 24 years.

What is a typical day for you?

I generally keep a conventional work schedule, although I do travel a lot for my job. Until recently, one of my kids would typically drop me off at work on their way to school, and I would get a ride home whenever my kids or wife could pick me up. Going to a conference now and then to listen to other people talk about their interesting research really helps to recharge the batteries. Sometimes I also get to go to field trials where there are tanks, helicopters, and loud explosions.

Like many scientists later in their careers, I spend a substantial amount of time now on administrative tasks: overseeing research projects, making presentations, writing reports and proposals, attending project meetings, and budgeting. Hopefully these efforts help to free up my colleagues to have their own productive research careers. When I am directly involved in the research these days, it most often involves numerical modeling and other computer programming. Although I may not be keeping pace with Stephen Hawking's late career productivity on black hole theory, I can still crank out computer code.

How do you feel when experiments/projects do not work out the way you expected them to?

Of course, it can be a real frustration to expend time and effort on an experiment that doesn't work out or on a derivation that leads to a dead end or to tracking down and fixing a bug in a program. On the other hand, when something does not yield the expected results, it often provides a valuable opportunity to reassess your assumptions. Acknowledge the unexpected and ask why it happened. One of my pet peeves is the seemingly obligatory "Good agreement was obtained between the theory and experimental results..." statement at the end of many papers, even when the agreement is not particularly good or there is no objective criterion for assessing the goodness of the agreement. The implicit assumption seems to be that papers are worthy of publication only if there is good agreement. But results that do not conform to our expectations can help us recognize knowledge gaps and lead to important advances.

Do you feel like you have solved the work-life balance problem? Was it always this way?

It has always been important to me to be a good parent as well as a good scientist. It hasn't always been easy, though. After leaving the office, my work often does continue at home. I have been quite fortunate that my family situation generally allows me to focus on work when it is necessary. (Or when I want to attend an ASA meeting!) But I do view maintaining a work-life balance as important to emotional and physical health and thus to long-term career success and enjoying life.

Familial considerations were prominent when my wife Nancy (who has an academic background in biology and math) and I decided to move to New Hampshire and I took the job at ERDC-CRREL. Northern New England has been a wonderful place to live and raise a family. We imitated the natives and learned to cut and split wood, tap maple trees, and cross-country ski. We raised four children, with the last one just about to head off to college. So now we are entering a new phase in our lives. Some of my best memories were going to my kids' school activities and coaching their soccer teams. I am also an avid gardener and read a lot of books, particularly nonfiction about history and culture.

What makes you a good acoustician?

My successes, as I see them, usually come from "associative thinking": recognizing connections between problems and synthesizing those connections into solutions. I'm not brilliant. But I do try very hard to formulate ideas logically and present them in a clear way. This probably stems from my liberal arts education, which I think

is very useful training for a scientist. Critical examination of one's assumptions leads to better questions, which, in turn, leads to better research. It's also important to cultivate the self-awareness to recognize which topics are ripe for productive research and which will turn into unproductive rabbit holes. Having grown up in Michigan and gone to school in Minnesota, I like to think that my midwestern sense of practicality is helpful in this regard. According to Jon Gertner's *The Idea Factory: Bell Labs and the Great Age of American Innovation* (which I highly recommend), one of Bell Labs' secret ingredients was midwestern scientists. Many prominent members of the ASA (e.g., Wallace Waterfall, Leo Beranek, and Richard Lyon) have fit that mold.

How do you handle rejection?

Being a perfectionist, it's disturbing when rejection lays bare the reality of being imperfect. I've gradually learned to set aside rejection and criticism for a day or two so I can better calm down and put things in proper perspective. It is important not take to take the criticism personally or conjecture unnecessarily about the motivations of others. Once I've had a chance to mentally process a critical review of a paper, I almost always realize that there are indeed aspects of the paper that need improvement or that maybe the reviewer didn't appreciate something because I didn't explain it clearly. Also, success in science, as with many other endeavors, often involves a competitive streak and taking pride in the quality of your work. I accept that the flip side of a healthy degree of competitiveness is struggling sometimes with rejection.

What are you proudest of in your career?

Winning the ASA Lindsay Award in 1997 was my proudest professional moment. It was very humbling because the awardees have included so many members of the ASA who went on to distinguished careers. Also, it seemed like I was leading a charmed acoustical life when I become a Fellow at the ASA 75th Anniversary Meeting in New York City. I am also very proud of helping to start *JASA Express Letters*, and it's been great watching *Express Letters* grow under the current editor, Charlie Church.

Outside of the ASA, I received a Department of the Army Meritorious Civilian Service Award in 2012. As a civilian employee of the Army, I really do take pride in helping the Army accomplish its mission of protecting our freedoms.

What is the biggest mistake you've ever made?

I've made plenty of mistakes but can't think of any one mistake that really stands out. My biggest *regret* is not being a better mentor for more people. I've benefitted from many fantastic mentors myself. But it's not too late to improve!

What advice do you have for budding acousticians?

First, be adaptable. Since the research landscape is changing at an accelerating pace, you will need a good grounding in the fundamentals but be ready to reinvent yourself repeatedly during your career. Second, push yourself to take the initiative. Shape your own research direction, make yourself indispensable, present your research at meetings, and take the lead in authoring papers. Third, try to focus on what really matters. We make decisions every day about what we *do* and *do not* work on. Make these decisions mindfully. Carve out blocks of time to think deeply, away from digital distractions.

Have you ever experienced imposter syndrome? How did you deal with that if so?

Most definitely. I suspect that just about all introverted scientists have these feelings, and scientists are more often introverts than extroverts. I once heard a psychologist explain that introverts feel like they are being phony and have something to hide even when they are being honest and have valuable things to say. If you take notice, you will see that others admire you for who you are.

What do you want to accomplish within the next 10 years or before retirement?

I would like to continue to advocate for a probabilistic viewpoint to outdoor sound propagation prediction, which acknowledges the importance of random variability and predictive uncertainties. Although such a viewpoint is commonplace in weather forecasting and other fields, sound propagation predictions are still typically presented as a single "exact" number, even though the atmospheric and terrain properties cannot be precisely characterized. It is challenging to change deeply ingrained conceptual frameworks.

A couple other topics I've been diving into lately, and look forward to continuing in the future, are artificial intelligence methods incorporating a physical understanding of the wave propagation physics and the modeling of acoustic phenomena in the Arctic.

I'm also looking forward to continuing to promote the Computational Acoustics (CA) Technical Specialty Group (TSG). Science is rapidly evolving, with a seemingly ever greater emphasis on simulation and statistical inference. The ASA has such a great legacy of scientific excellence in its publications and meetings, which must be preserved while also keeping up with emerging trends. The enthusiasm for the new CA TSG has been rewarding to experience.

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