Why a Scientist Might Sell Her Soul in Corporate America

By Cynthia Furse, Ph.D.

Well, I guess that title caught your attention, didn't it? Scientific academics, me included, often pride ourselves with being above the 'base' desires of making money, courting customers, and running a business. Instead, we are motivated by the thrill of scientific discovery, the challenge of creating something new and novel, the wonder of analytical reasoning to find/prove/discover something special, perhaps finding something unexpected. Imagine my surprise over the past eight years as I have discovered that pure academics and corporate America are not so very divergent after all.

In 1998 I happened upon an idea, an invention if you will, of using a coded cell phone signal to locate intermittent electrical faults on aircraft wires while the plane is flying. Most faults happen in the air (vibration, moisture, stress, heat, cold …) and many disappear before the plane lands, thus leading to the frustrating and potentially dangerous 'no fault found' condition where a maintainer knows something is probably wrong but cannot find it. After some large and clunky lab tests proved out the basic idea, my first Ph.D. student, now Dr. Paul Smith, built a sleek and functional board to demonstrate the system and work out the theoretical constraints. Cool! Publication-publication-publication. A couple of patents. Some conference presentations. And that is where my typical world of National Science Foundation (NSF) funded academics would normally have stopped.

But it didn't.

The demand for this technology as a product was clear. The Centers of Excellence program came to my aid just when my Department of Defense (DOD) and NSF program managers were strongly encouraging me to set up a company to move the technology to the next level, and eventually to a product they could purchase for their fleets. From my academic position, 'development' did not look half as interesting as 'research'. Little did I know, development is often the instigator of much more research.

Paul Smith, then recently graduated, and I, along with two business partners, John Bennion and Bob Sherwin, created LiveWire Test Labs, LLC to commercialize the technology we originally developed at the University. Eight years, a few grants and major government funding later, the technology is truly maturing into a product sought after by major avionics manufacturers and aircraft producers around the world. Besides the sheer magnitude of what, who, when, and how, I think the thing that surprised me most was how little we knew when we started and how much pure, raw , funded academic research was waiting in the wings, as well as how many really cool problems we would have missed had we stopped at the end of the traditional academic cycle.

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For instance, real wiring harnesses have branches and connectors and lightning protection circuitry and loads and all kinds of things that 'pollute' the reflectometry signal we were seeking. Analyzing all of those elements has led to three master's theses, several publications and a really cool academic question: Just how low can we go? What is the fundamental limit of the sensitivity of this system? Is it possible that there is no theoretical limit, but that the hardware configuration is all that limits its sensitivity? This led to some fascinating studies (and more master's theses along with part of a Ph.D. and multiple publications) on how to push the noise level down low enough that we can find faults in prestressed concrete anchors for dams and early-stage corrosion on connectors. The signal processing is also a good academic research project: How can we extract our coded pseudo noise signal from everything else, the coded needle in the aircraft haystack, efficiently and effectively? Challenges in low power to make the system battery operate led to my current research collaboration with Dr. Steve Blair on an optical correlator that can do the same job instantaneously with miniscule power using light.

So as you see, the more we know, the more questions are created. One of the most fascinating recent unanswered questions is what really happens when a wire short circuits? The sputtering, burning, spitting short typically lasts less than a millisecond, often more like a few hundred microseconds. The heat and plasma flume are highly variable with time, and they do affect the reflections that are observed. The company has developed some really good algorithms to deal with this, but the academician in me wants to take it further – to a real understanding of the micro-explosion that occurs . I want to know what happens to the wire, what happens near the wire, how this affects the instantaneous signals on the wire, and how this impacts our test system. It seems that no one really understands the electrical environment around a short circuit micro-explosion, so we are currently preparing a collaborative research grant to study this intriguing issue. This is yet another thing that I didn't anticipate when we 'finished' our first academic research and moved on to development.

Somehow, I very naively assumed that development meant the research was done. I forgot the fundamental principle that the more you know the more questions you raise. Development helps us know more, and simply through the act of forcing us to really apply what we have learned, development has been an excellent catalyst for more pure research, research that has continued to fund students, publications, and conferences. So, no, I don't think I had to sell my scientific soul when I straddled the academic to corporate divide. Instead, the corporate challenges have added soul to my academic research, soul that could otherwise have been so easily missed.