

Clean Hands

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I remember, as a child, sitting with my mother while she was kneading dough. She observed how your fingernails are always clean after you finish kneading dough. Her point wasn't that cooking is a great way to clean your hands. Her point was that it's important to have clean hands before you start.

There are plenty of analogs to this in our business. There is an obvious one in the semiconductor industry, after all we do all our manufacturing in clean rooms and the personnel are all scrubbed and gowned. They aren't baking bread in the cleanroom; they are making something much more advanced.

We design semiconductor products in my office, we don't fab them here. After we had been in operation for a few years one of the engineers observed that the lab was a mess. I hadn't really noticed before, but he was right. With time it gradually became messier and messier. So we set up a lab cleanup day, where everyone was asked to clean up the lab, starting with their own work areas. The improvement was startling. We disposed of barrels of old parts, packages, boxes and obsolete equipment. I can't prove it, but I'm sure our lab became much more efficient. There were no longer bewildering nests of wires to sort through and comprehend. It was easier to find things. There was space to put things. So we now have a monthly lab cleanup hour to keep the lab neat and efficient.

Similarly, we periodically have all our equipment calibrated. It gives us confidence in what we measure and what we deliver to our customers. Years ago I worked on mm-wave IMPATT diode amplifiers. Equipment was primitive at the time. None of the major test equipment manufacturers was selling equipment at our frequency yet. It was a rite-of-passage for each new engineer to calibrate a test bench with a calorimeter – comparing the power absorbed by a flow of pure water across a waveguide to a dc heat source. It was tedious work, but gave accurate results. I worked in that lab for 2 years, and we never recalibrated a test bench. Given the nature of our power detectors, that wasn't a great idea. At one point I measured one of my amplifiers on a neighboring bench, and found that the results weren't the same. So I compared all four test benches in the lab, and found a significant distribution. I asked the most senior engineer in the lab what we should do, and he suggested we correct all our calibration tables to agree with one of the benches. Which one? The one that gave the best results. I felt dirty!

A few years later, when I moved on to the glamorous world of MMIC development, we hired an experienced microwave engineer to manage our test lab. The first thing he did was to collect all the cables, adapters and miscellaneous passives in the lab, including everyone's personal stash. He then came in on a Saturday and spent a long day measuring everything he'd collected. On Monday he reported that he had found that over a quarter of the components were bad – loss too high, VSWR too high, performance far out of specification. We disposed of all the defective components and purchased replacements. How many bad measurements did he prevent? How many bad measurements had we made before? It's hard to say, but it was a worthwhile exercise.

Of course, even the best intentions to make sure everything is clean and ready can be foiled. A past colleague had an important sample delivery to make to a key customer. He had planned a family vacation shortly after the scheduled delivery. Of course, his drive was delayed in traffic such that the delivery would need to be made while he was away. (An observation – never plan a vacation around an important project deadline – tapeout, delivery, presentation etc. In my experience the deadline always gets shifted and ends up in the middle of the planned vacation.) Since he wasn't able to shift his trip, he made sure everything was prepared to be done properly in his absence. He made sure that the assembly requirements were well documented and the assembly supervisor knew exactly what to do. He made sure the test equipment was working properly. He coached the young engineer that was working with him on exactly what to do and had him go through some trial runs. Then, right after he left on vacation, his manager decided he needed the young engineer for another project and assigned a technician unfamiliar with the project to look after the delivery. You can guess what happened. The assemblies were built. The new technician measured them and got unexpectedly good results. Everyone was pleased with the outstanding result, told the customer to expect better performance, and shipped out the samples. What they didn't realize was that technician made a testing error that exaggerated the performance of the parts. When the customer measured the parts they were both upset with the performance and disappointed in our integrity. You can imagine who was blamed.

The lesson isn't that you shouldn't bother making sure everything is clean and ready. You should, but even then, be wary for what might go wrong. And wash your hands!

There is an episode of the Seinfeld television program where a pizza maker, leaving a restroom without washing his hands, tells Jerry that he's heading to the kitchen to personally make a special pizza for him. His hands may not have been clean at that moment, but they were clean after he finished making Jerry's pizza. When I saw that, it reminded me of what my mom told me, many years before.

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