

# A Tom Swift Life

By Mike Rainone



The foundation of becoming a theoretical powerhouse is to understand what it is to “know” something.

Since I was child I have read science fantasy books, as did many a young man in a generation born to the awakening of electronics, rocketry, and the atomic era.

But my earliest recollections are the adventures of Tom Swift Jr. and the Electronic Adventure Series of Rick Brandt both of which I suspect were penned by the same guy who's nom-de plume was Victor Aplington, Jr., if memory serves.

Tom spent his life solving problems with science and engineering wizardry in places like The Caves of Nuclear Fire, all the while jetting around the world in an atomic aircraft. Rick Brandt lived with his Ph.D. father on Spindrift Island off the New Jersey coast, with a semi-communal band of brilliant scientists taking on the world's greatest technological challenges.

It seems strange to say that after 61 years of life, I might have succeeded in achieving part of that Tom Swift life. Please understand that I don't fly around in atomic aircraft, and even if I had an atomic aircraft, I lost my pilot's license a few years ago to diabetes and the general physical neglect called aging.

I don't live on an island off the coast of New Jersey, though I suspect if there were an island off the coast of New Jersey it would already have high-rise condos on it. I do, however, live on a 65-acre campus, which is not a commune, 20 miles from the nearest grocery store, in the piney woods of East Texas; and, with a lot of help, we have built a technological problem solving business complete with brilliant engineers and scientists. Not exactly Tom Swift, but not too bad either.

The realization that I had arrived on a track parallel to Tom came home to me in the past year or so. Four years ago, my company had a bare minimum staff of one electrical and one mechanical engineer, and we were doing fairly traditional, somewhat mundane work: making this gadget work, or programming that electronic circuit. Today, we've become a full service R&D, science, and engineering powerhouse with really spooky smart people going in directions that Tom would never had thought possible.

I was reminded of this the other day, as I was sitting in a conference room with two of the wizards that make this all possible, listening and participat-

ing in my own lame way in a discussion about current flow in electrophoresis-like devices, with everyone theorizing about what was carrying the ions: current, pseudo current (whatever the heck that is), electrostatics, magnetics, or evil spirits.

While the debate raged on, I sat back in one of those stupor states, when you detach and look around and wonder how you got there and in that almost existential of moments you realize that your life's dream has come a reality. I was dancing at the edge of a wonderful scientific debate that I had no business being in, but was blessed to witness, and even more blessed to be able to pay for the time it took those two brilliant minds to duke it out. In that moment of reflection, I looked back on the events of the past few years and saw a path of intent or purpose that could almost be seen as divine if one wanted to subscribe to that, since I certainly don't believe that I had the wisdom to guide us through all of those wrenching curves and over the incredible potholes that describe this country's economic turmoil the past few years. Somehow, I realized, we had become a theoretical powerhouse, and I can, in all humility, describe it that way because of a shift in people, tools, and direction.

Most of you dear readers understand that I am personally only an amateur engineer and a dabbler in the sciences. I perceive myself to be, because of my doctoral work in cognitive psychology and through the mentoring of Dr. Selby Evans at TCU, an expert on problem solving, scientific “knowing,” and epistemology in general. To me, the foundation of becoming a theoretical powerhouse is to understand what it is to “know” something. To a certain extent, this orientation is now being copied by engineering schools in courses on the Design of Experiment, a path that I heartily endorse.

The second part of this shift comes from people. Not all Ph.D.'s are good theoreticians, and not all theoreticians are Ph.D.s. We have both kinds. What is fundamental is the ability to have both the mathematical foundations of their discipline firmly in hand, as well as the deepest understanding of how those mathematical parameters impact the physical world. I think this may be the critical distinction between the true theoretician and the everyday scientist or engineer.

Most engineering graduates get through by surviving the math, from calculus to diffyq, in order to get to the engineering curriculum. In your careers, when you need a formula, you might check an old textbook or look in Mark's when you need it. The true wizards fully “grok” the math; they can derive the equations from memory, and they can visualize those mathematical relationships as they interact with the physical world. What is weird, in our case, is that the theoreticians have improved the work of the “real” engineers, and vice versa. What seems like common sense and good old hands-on engineering has now become grounded in theory and practice.

Of course, having the tools, like the 3D modeling, multiphysics FEA, CFD and the like, helps immensely. To be able to build, for instance, a linear motor in 3D mechanical CAD and then subject it to a robust mathematical simulation in a multiphysics FEA, and determine everything from force profile to heating and energy consumption, makes the move to the prototype shop much less problematic and expensive for the project. This has fundamentally moved us from hackers to efficient product developers.

I suppose nothing would actually change without a change of direction. While in the past we did a fair amount of “innovation” for the client, the past few years has seen a shift to the most fundamental problem solving and hard core invention. When faced with some of the most profoundly difficult problems in the most difficult environment, when the devices sell in the million-dollar range and the liability for failure starts at a hundred times that, the game must be grounded in theory with an ability to execute flawlessly. This is no realm for the amateurs; it's the realm of Tom Swift.

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