

A Most Fortunate Individual – My 27 Years at HP & Agilent

--Steve Fossi, HP - 1978 - 2005



Foreword

The Santa Rosa Experience —Steve Fossi

In the Golden Years of High Tech, following the war-winning success of electronics in WWII, Hewlett Packard Company began its long rise to become one of the world's largest and most respected organizations. The product line, born with the HP 200A Audio Oscillator of 1939, was dedicated to electronic measurement instrumentation. From 1945 onward, it remained instruments and data acquisition, until the introduction of the HP 2116A Instrument Computer in 1966 and the HP 9100A Desktop Computer in 1968. One corporate acquisition of Sanborn Medical Corp of Waltham, MA did begin a separate line of medical products. This was probably the personal decision of Bill Hewlett, whose family had a distinguished medical lineage and genealogy.

In the electronic instrumentation, which was separated into divisions in 1962, there was no more successful product line than the Radio Frequency, (RF)/Microwave Division. The technology was spawned out of WWII, and creatively expanded by some microwave engineers who were recruited out of the wartime development labs. From 1962 to 1969, while the average HP corporate growth rate was about 15% per year, doubling every 5 years, the Microwave Division grew from \$20 million revenues to \$75 million, or tripling in that same period. The dependable company-wide revenue growth spurred more building and recruitment. More importantly, it led to the executive decisions to move to new cities, Loveland and Colorado Springs, Colorado.

We used to congratulate ourselves by adopting the concept that HP sold more than electronic hardware. We sold MEASUREMENTS. It followed the age-old sales seminar technique which proclaimed that when you went to the local hardware store to buy a 1/4 inch drill bit, what you actually needed was a 1/4th inch HOLE. So, in a real sense, Hewlett Packard invented entirely new measurement techniques to go along with the new instrument hardware. Thus, in the 1960s our microwave product lines proceeded into two dramatic new measurement functions, Spectrum Analyzer measurements and Network Analyzer measurements. These two new product lines quickly pushed microwave sales to the \$100 million mark, and by 1970 plans were underway for sending half of the division line to Santa Rosa, in a new Fountain Grove facility campus.

As we will see in this memoir of Steve Fossi's HP career, his life experience is basically the same as perhaps a thousand other young men and women who graduated with engineering or MBA degrees and were recruited to join HP across the world. In my 1960s years as Marketing Manager of the Microwave Division, I tended to use the military metaphor for our organizational strategy. Brand new graduate engineers were considered 2nd Lieutenants, MS or MBA degrees might qualify as 1st lieutenants. Organizationally all our three main functional departments, engineering, marketing and manufacturing were divided into product teams. So a new instrument design team in the lab might have from 5 engineers and upward. Thus the Lab Project Manager was equivalent to a military Captain and the Lab Section Manager might be equivalent to a Major.

The military metaphor worked well in encouraging team building, brand new engineers were immediately assigned design work under the mentorship of experienced (but not necessarily much older) engineers. But with regard to creativity and self-motivation the military metaphor did not apply. The HP Way provided one key rule, Management by Objective, meaning that design orders did not come from the top, but were devised by the team as they went through their project timing. Steve's memoir does a great job expressing how he moved into this well-honed work culture, how his project work was mentored and monitored and enlarged.

In Marketing teams, legendary mentors like Blake Peterson took the fledglings under their wings, for both the technical lookup procedures as well as the Factory Expert telephone etiquette. Often these senior personnel might have Navy Chief experience in their past, so they might appear gruff and grumpy. Names like Dave

Widman and Cliff Jones and George Springer would bring smiles to the faces of old Field Engineers, who knew that a call to any of those senior experts would likely as not, bring a technical answer off the top of their heads, without waiting for a callback. This could be extremely valuable if the call were coming from the desk of a customer, who was making a last minute buying decision.

So the work culture of the HP Way was passed on day by day. One value of the bull-pen arrangement of desks was that the neophyte engineer was usually sitting next to his manager, so telephone calls were overheard by all. How does your manager handle a confronting issue with manufacturing deliveries? How does a senior design engineer handle technical calls from vendors who are negotiating specifications and quantity price decisions? In some cases that I recall, you even learned something about a man's home life, if he chose to talk to people from home on his desk phone.

Buttressing this strategic plan to hire our engineering staffs mostly from BS degree graduates across the nation was a brilliant recruiting program. It was a massive investment with literally hundreds of our technical staff involved. I never saw actual numbers, but as a guess, we probably had teams for 100+ colleges. Their objective was to establish and maintain VERY close relations to the key professors. This might be done with instrument donations and other personal support such as lecture visits to classrooms. What we got out of that was the identification of top candidates. This all led to on-campus interviews and offers for travel to factory visits. It goes without saying that that the factory interview teams who used up the whole day, started with a team member picking up the candidate for breakfast. At least one interviewer would handle the high pressure technical inquisition, and the rest acted like sales people, working for an acceptance for the right identified winner candidates. Usually the team met for an up/down vote before the visitor left the plant, such that the team member who drove the young person back to the airport could make a job offer on the way.

Typically the leading new engineers would be ready for promotion to team leader within 5 years. There was considerable evidence that engineers who encouraged internal movement from marketing to production or lab to marketing often made the best promotional candidates, obviously with their improved functional experiences. You will learn from Steve's story that promotions and suggestions for moves to outposts like European offices came unexpectedly. With the magnificent new RF/MW instrument products of the late 1970s and early 1980's being built for functionality using internal microprocessors, the measurement capability multiplied significantly. Enormous computational power now resided within an instrument, without the need for control by an external computer.

But threaded through Steve's story we can see how the product teams learned to manage product strategy, what does the customer need—years before the customer KNEW they needed it. They learned how to anticipate what communications technology would be doing to the mobile telephone and the cellular base station installations. More importantly you will see how the management needed to get their organizations properly separated in product divisions, and work out conflicts on research budget funding. Yes, even with HP's terrific work culture, there were territorial product line wars at the management level.

Things became serious with the major corporate decision to spin off the instrumentation product lines from the completely different consumer lines of printers and personal and commercial computers. This led to the formation of Agilent which assumed the chemical and electronic lines. It all happened at the turn of the century, and Agilent began with enormous production backlogs of orders, in Steve's case the remarkable success of the visionary automatic tests systems. They had cleverly been able to exploit the functional measurement power to customize test systems for specialized markets such as antenna pattern testing and production test for the tiny sophisticated radio frequency components needed in new generations of cell phones.

But the bursting of the first Internet "bubble" left Agilent with a large excess of personnel. Some of Steve's worst times were in the realization of the terrible decision for large personnel layoffs. The HP Way didn't really provide for that, it was wrenching. His personal turmoil and that of other managers shows through. At other times, his willingness to call in outside consulting for resolving major organizational decisions, given major HP executive personalities is also revealing.

This memoir is going to give you an inside look at the most challenging side of management. Well worth the read. You will learn it is not all about the corner office, first class airline travel, and nice bonuses.

--John Minck

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Introduction

I thought I'd write down my remembrances from my time at HP and Agilent, before all of my memories faded any further. I worked for HP from 1978 to 1999, and then at Agilent from 1999 to 2005. My entire career was spent in RF and Microwave instrumentation, and, except for a few years spent as a Foreign Service Employee in the Netherlands, I was based in Santa Rosa the whole time. I started as a fresh-faced college graduate and ended up as a Vice President and General Manager for two different operating divisions of the company. But as you'll see, I had a lot of help along the way. I was truly a most fortunate individual.

My Introduction to HP

Growing up in Pennsylvania, I had always been a good student, and in fact I won the award for best math & science student in both my junior and senior years. But my true passion was music. I played the triple drums in our high school's marching band, and the tympani (my favorite) in our concert band. Our high school band was no ordinary organization; we won the national championship four years in a row while I was in it.

As you might imagine, this was a bit all-consuming. Practice for the fall competition season started on August 1st, with two-a-day drills, just like the football team. Once the school year started, Band was a class (conveniently, the last one of the day), and it was almost always followed by 60 or 90 minutes of after-school practice, and I always practiced for another 30 minutes each night at home. Each weekend, we played at halftime at the football games, and then we usually had to take buses to a field show competition. This was all supplemented by one or two halftime performances at NFL games, plus the national field show championships in the late fall. In the spring we put on a big concert for the community, and we prepared for the parade and concert national championships.

I loved every minute of it. But my bandmates were also very good, and I recognized that while I had the work ethic and I was a good "technician," I didn't have the "it" factor that you needed to make it a career, so I decided I might eat better, and more regularly, if I developed my math and science skills instead.

So off I went to engineering school, and after four very challenging years, I got my bachelor's degree in Electrical Engineering from Case Western Reserve University in Cleveland, Ohio. Case had a good reputation and a quite rigorous program, including a requirement that about half of the senior-year credits had to come from a senior design project. So a lot of top-tier companies recruited on-campus, especially those who were based in the Midwest. 1978 was a good year for hiring, and since I had a high GPA, and the senior project my partner and I were doing was in the running for the best project award (which we ultimately won), I had several job offers.

The top of my list was a digital design job at Texas Instruments. This was what I had trained for in my coursework, and TI was certainly a powerhouse in the field. Another contender was Bell Labs, which was going to pay all expenses for my masters' degree. And then there was HP's Santa Rosa Division. They were in California, where I knew no one; they had the lowest salary offer (although in fairness, not that much separated any of the offers); they wanted me to work in Marketing, which I knew nothing about; and they wanted me to work in microwave, which I also knew nothing about. So, with the logic typical of a 22-year-old, I figured, "what the hell, it could be cool," and I accepted the offer.

My first job at HP was working as a Regional Sales Engineer (RSE) in the sales support department. My boss was Joe Gattuso, but my day-to-day mentor was Blake Peterson. Blake was already something of a legend when I joined, having earlier mentored many microwave newbies and worked alongside luminaries such as.....John Young, our CEO! He asked me if I'd found an apartment yet, and when I said I hadn't, he said my first assignment was to find a place to live, and then come back when I'd done that. It was my first experience with the HP culture – management by objectives, and the high trust placed in employees. There was no “you have this many days,” or “we want daily updates to make sure you're not wasting your time,” or anything of the sort. It was just go do it, and come back when you've done it.

A few days later I went back to the plant and told Blake I'd found a place. He smiled and said, “Well, you're going to have to go home and change.” When I asked why, he said this was the last day of the annual sales meeting, and it always ended with a canoe trip down the Russian River. Thus, my first full day at HP was spent floating down the Russian River with a bunch of sales guys and marketing guys in various states of inebriation. I was beginning to feel pretty good about my decision to join HP!

Regional Sales Engineer

A few days after the canoe trip, another new college grad joined the sales support team, and was given the desk next to me. His name was Lorenzo Freschet, and although of course we didn't know it at the time, we would spend most of the next 25 years working together (and, on a few occasions, damn near getting fired together!) on various projects.

But for now, our job was to learn the products and learn the business. This was mostly done by on-the-job training – you'd take a call from a Field Engineer, tell him (and the sales force was nearly all men back then) you didn't know the answer, and then go find the answer and get back to him. Slowly, you would be able to piece together what the hell was going on, and in the meantime you were making an immediate contribution by helping with the call load. It took me two months before I was able to answer my first call without having to look it up first. That may not seem like a long time, but there were a LOT of calls, as the phones were ringing all the time. Lorenzo and I were constantly scrambling to answer them all, as another veteran, John Knobel, had threatened us with bodily harm if calls weren't answered within two rings. These were the old, black, indestructible AT&T dial phones – and of course there was no voicemail – and Lorenzo and I spent so much time on them that we both developed ear infections.

My job had a unique twist. Because Blake supported the sales from HP Intercontinental (ICON, as it was called), a lot of my work for Blake was written. E-mail was still five or six years in the future, and overseas phone calls were expensive, unreliable, and often poor quality. So we would get questions via the company's Telex (teletype) system. Then we would hand-write the answers, the telex operator would enter them into the system before the end of the day, and the message would get sent that night. It was a slow cycle, and so Blake taught me how to anticipate the next question, and then answer it in the same message. This was a valuable skill to learn, and it served me really well decades later, when I was doing big-ticket selling for systems that cost millions of dollars.

The call load was supplemented by systematic learning. One aspect of this was the Neophyte Program. RSE's were expected to know the basics of *all* HP Test & Measurement products, and so off Lorenzo and I went, to Loveland, Colorado Springs, San Diego, Santa Clara, and Palo Alto. We were joined in these training sessions by newly hired Field Engineers from around the globe, and it would be hard to overstate the value of the relationships we formed during these

trips, as they served us throughout our HP careers, especially when many of us ended up in senior management positions.

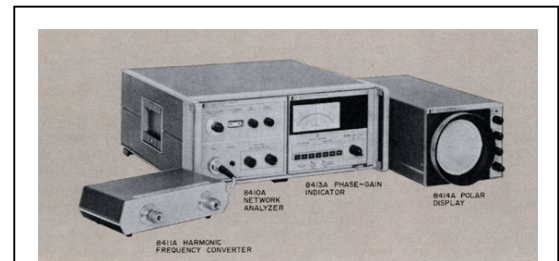
Inside the factory, the systematic learning was divided between spectrum analyzers and network analyzers. For spectrum analyzers, it was straightforward: you just worked your way through App Note AN-150: Fundamentals of Spectrum Analysis. AN-150 had been written as the "bible" for the design use for spectrum analyzers. Since the new HP 851/8551 had both exceptional sweep width and 60 dB dynamic range, it was FAR more useful than industry competitors. And whenever I had a question, I would ask Blake, who, as far as I could tell, knew everything.



The HP 8551/851 Spectrum Analyzer was our first blockbuster product in 1965. It became the grandfather for half of the Santa Rosa Division.

For network analyzers, the road was a bit longer and rockier. The Santa Rosa Division had developed two free seminars we gave to customers, scalar measurements (i.e. magnitude-only), and vector measurements (i.e. magnitude and phase). Our goal was to be able to teach these seminars, with the idea being we couldn't teach them unless we understood them first, inside and out.

Lorenzo and I were joined by Bob Cannon, an HP veteran who had run the division's Special Handling group, but had recently transferred into Marketing. We would slog our way through the material, and when we had learned an entire section, we would present it to Blake, who would then promptly and gently rip us to shreds, either for being unclear, or for not understanding the measurement concepts well enough, or most often, both! For a change of pace, we would sometimes present to John Knobel, or to Jimmie Davis or Jim Kaylor, two other experienced RSE's, all of whom were similarly difficult to please.



The HP 8410 Vector Network Analyzer, introduced in 1967, was the foundation of the second half of the Santa Rosa Division..

In truth, of course, we were lucky to get all of this feedback before ever presenting to a customer. The veteran RSE's knew that if Lorenzo or I were giving this seminar to a customer who had a couple of decades of microwave design under his belt, we wouldn't have experience on our side, so we'd sure as hell better have knowledge.

Our "final exam" was to give the scalar seminar to some of our technicians from Manufacturing. To make it more realistic, none of the experienced RSE's attended; it was just us and the techs. I also had the opportunity to present the vector seminar in the Neely (western) sales region. My partner was a Neely employee named Herb Pardula. Herb's title was "HPIB Specialist," which was the forerunner of the Field Application Engineer jobs that would come later on. Here again, I lucked out: Herb was super-competent and relaxed in front of customers, the perfect complement to a jittery rookie such as myself. I learned a lot about interacting with customers just by watching him work.

After a year, the Santa Rosa Division was split into two new divisions: the Signal Analysis Division (SAD), and the Network Measurements Division (NMD). Lorenzo and I were both assigned to NMD, and Scott Wright, the new NMD Marketing Manager, was surely more than a little nervous about turning over his two largest sales regions, the Eastern Sales Region and the Neely Sales Region, to two guys barely out of school. But the training we'd received was solid, and we worked pretty well without our safety net. When Joe Dunst joined a couple months later

as our Sales Manager, he was able to coach us in sales skills, to complement our growing technical skills. Once again, I had been fortunate to get just the right mentor at just the right time.

The HP8340A

By 1980, the biggest project in the NMD lab was the 8510A network analyzer. Everyone felt it would live up to its hype as the “product of the decade.” It was also seriously behind schedule, and the joke was this was intentional, because it wouldn’t be right for the product of the decade to be introduced too early in the decade! But it was looking like a late 1983 introduction, while its companion source, the 8340A synthesizer, looked like it would be ready by early 1982.

The problem was no one in NMD knew what we could do with a stand-alone source for roughly two years until the 8510A was ready. I had expressed an interest in moving to Product Marketing, so in the fall of 1980 Larry Stratford asked me to make the move and figure this problem out, and then lead the marketing introduction of the 8340A. I think the theory was, “Well, since none of us know what to do with it, let’s have the kid take a shot at it.”



Of course, I didn’t know what to do with it either! But thanks to my RSE experience I did know a lot of Field Engineers, and I knew how to ask questions and how to listen. So I put together a survey and began calling all my Neely sales buddies, and the picture that emerged was that we could sell the 8340A into military ATE (Automated Test Equipment) systems. HP had been successfully selling the 8672A synthesizer from the Stanford Park Division into these applications, and the idea was that the 8340A, with its wider frequency coverage (it went from 10 MHz to 26.5 GHz, while the 8672A went from 2 – 18 GHz) and sweep capability, would be a good upgrade as ATE systems got modernized. We were off and running.

I reported to Russ Johnson, who was the product manager for all the swept sources NMD made for their network analyzers. Russ was a superb manager. He was great at delegating, and great at lending support when you needed help. It was Russ who sat down with me and walked me through every line in the income statement, and explained what each meant. Moreover, he could explain the accounting used in each line and how much uncertainty there was in it. For example, we used a division-wide average for warranty cost. This meant that products that were less reliable than average looked a bit more profitable than they really were, and vice-versa for highly reliable products. And it was Russ who helped me navigate through the various checkpoint meetings we had as part of our New Product Introduction (NPI) process. Once again, I had been very fortunate to exactly the right person as my first boss in product marketing.

The 8340A made extensive use of phase-locked loops (PLL’s), and it was just this sort of analog circuitry that had driven me to specialize in digital systems in college! So I struggled to understand how the damn thing worked at first. Fortunately, Carl Enlow, the project manager, was very generous with his time, and I slowly started to figure things out.

The 8340A was a very complex product, and so Carl had assigned a full-time engineer, Jim Bossaller, to focus on reliability. Jim’s approach was brutally simple: test it until it breaks, fix and improve what broke, and then repeat. For years after we introduced the 8340A, we would get reports of the product continuing to work under all sorts of harsh conditions, a testament to the

effectiveness of Jim's methods. The focus on reliability was a perfect match with the "10X Quality Improvement" campaign that John Young had launched HP-wide in 1980.

The 8340A's complexity also meant that much of its tuning and testing would have to be automated; there was no way technicians could manually tune the product cost-effectively. Two bright young engineers were assigned to the task, Jim Terhorst and Mike Seibel. It would be hard to overstate their contribution; their work on the 8340A really paved the way for how production testing would be done on all NMD products from that point forward.

Russ let me take on as much responsibility as I wanted, and so I did just about everything. The data sheet, forecast, pricing recommendations, competitive analysis, demo guide – you name it, I did it. I even wrote the plastic pull-out card that was attached to the bottom of the instrument.

About eight months before our introduction date, Joel Herviault was brought in to help me out. Joel was a Foreign Service Employee from France, where he had been a Field Engineer. As you might expect from a guy who grew up in France, his English was not the best, so I had to (heavily) edit everything he wrote. But he knew his stuff, and he had manic levels of energy, so we made a good team.

We introduced the 8340A in August of 1982, and started with the European NPI tour. Lorenzo had moved to South Queensferry, Scotland, a few months earlier to become our European product line manager, so he and I ran around Europe for 4 weeks training the Field Engineers. The adventures, mishaps, and close calls we had during that month are best saved for a different type of memoir! But we survived, and the reaction from the field was generally positive, although tempered by the 8340A's exorbitant price tag. It was just under \$70,000, which is expensive by today's standards, and an outright fortune in 1982. But if you looked at what it would cost to get the same frequency coverage in a different way in an ATE system, plus the savings in rack space and spares and programming effort, it began to look.....well, pretty good! One of Dave Packard's business rules was: We Price for Value.

I spent a fifth week training our reps in Israel, and then returned home. A few weeks later we did the U.S. NPI tour. The result of all this effort was, honestly, a bit underwhelming. We were getting orders for around 4 units a month. Not a disaster, but still, after all our work, I think we were expecting more. We were working on several ATE deals, but none of them had arrived yet. So we bobbed along at 4 – 5 units/month for several months. There was never any discussion of taking the product off the market, because after all, it was going to be the companion source for the 8510A.

Finally, in August of 1983, exactly one year after introduction, our first two big deals hit. We received orders for 83 units! From that point forward, I don't think orders ever dropped below 25 per month. This was probably because by then, the world's worst-kept secret – that the 8510A would be introduced in January of 1984 – was known by just about everyone.

The 8340A, and its follow-on products the 8341A and 8340B/41B, set high standards for reliability, serviceability, and for their highly automated test procedures. I was never able to get an exact number, but I know that over the ten-year life of these products, they made nearly \$500M in revenue. I can recall customer visits as late as 2012 – 20 years after discontinuance – where I saw them in test racks, still chugging away, simply because they still did the job and had never failed.

All in all, not too bad for a product nobody knew what to do with.

Product Manager

While Lorenzo and I were running around Europe introducing the 8340A, things were changing in Santa Rosa. When the dust settled, Russ had taken a different position in NMD, and Larry Stratford offered me the job of sources product manager while I was still in Europe. So when I came back from five weeks in Europe, not only was I really tired, but I was now also an HP manager.

Product manager was a key role in the way the HP divisions were set up, because everything came together here: manufacturing issues, forecasts, profitability concerns, R&D schedules, competition, and on and on. I had many days where I would walk into work and be stopped multiple times on my way to my desk. I'd get to my desk and look up to see the clock already said 10:30. I had other days where I'd touch base with a few people, a few more would visit me, I'd take a few phone calls from the field, and then look up to see that somehow it was already 5:30. And from all this swirling chaos, the job was to figure out what really mattered.

I had plenty of help. Larry was a very good coach with a strong analytical mindset. And during the four years I held the job, I was blessed with a uniformly strong set of product marketing engineers who worked for me. Many of them went on to have lengthy careers at HP and Agilent. HP Corporate also had a valuable set of classes for new managers, to teach them how to manage "the HP Way." We learned basic things like how to write a performance review and how to administer salaries, and not-so-basic things like how to provide effective coaching and motivation.

Arlen Dethlefsen was my R&D counterpart, i.e. he managed all of the R&D projects for sources. Right after I started the job, he began stopping by my desk almost daily. At first I sort of resented the intrusion on my time, but after awhile I accepted it. After all, even though we would talk about all sorts of things, we usually spent at least some time talking about the product line. About a year into the job, I was attending a class on product management in Loveland, with product managers from all over HP in attendance. The instructor asked for a show of hands on who had disagreements with their R&D counterparts over product strategy. Everyone in the room raised their hand but me. That's when the light bulb finally went on! Arlen's daily visits were actually his low-key way of keeping us aligned on what we were doing now, and what we should be doing in the future! He had perfected the art of Management by Wandering Around, and it only took me a year to figure that out!

I also got unexpected help from our division General Manager, Bill Wurst. That made sense – a lot of the division's revenue and profits came from sources, especially after the 8340A took off. But Wurst also knew that we went head-to-head daily with NMD's biggest competitor, Wiltron. And I could never tell if he just really hated them, or if he just really loved beating them, but whatever it was, he stopped by often, always with new suggestions on how to make Wiltron's life miserable. Of course, most of his ideas were un-implementable, but I came to admire his seemingly inexhaustible creativity when it came to dealing with our competitors, and his singular focus on beating them. One of Wurst's peculiarities was the longer he talked to you, the further his glasses would slide down his nose, so that eventually he could peer over them and look right at you for emphasis. One time, we were talking about the launch of two new sweep oscillator plug-ins, neither of which Wiltron would be able to match. "Yeah," he said, "I figure we launch the 83592A, then hit 'em with the 83595A." Then, pausing for a beat, he looked over the top of his glasses and said, "By then, they oughta be getting the message."

The 1980's were the time of the Reagan administration's big defense buildup, and the sources product line sold heavily into Aerospace / Defense, and so we were a beneficiary of this policy. We had healthy growth every year I managed the product line.

The 8510A

In January 1984, NMD was finally ready to introduce the product of the decade, the 8510A vector network analyzer. This was a massive introduction, and so it was all hands on deck. I was assigned to do the Asian NPI tour along with the Asian RSE, Suzanne Frick.

Outside of Japan – which was huge for NMD and had a separate NPI team – Asia did not generate much business for us back then. We could not sell at all to China, so we had some business in Hong Kong, in Taiwan, and in Australia, and that was pretty much it. So those were the three stops Suzanne and I made, with several misadventures along the way. Traveling throughout Asia nearly 35 years ago was *considerably* different than it is today!

Everywhere the NPI teams went, the 8510A was received as the revolution it truly was. Astoundingly, it felt like, if anything, we had *undersold* it by calling it the product of the decade! It seemed like the entire microwave industry was ready to move from dent tuning and other such “black arts” into the modern digital world, and the 8510A was the chosen vehicle for the journey.

The development of the 8510A is a story all unto itself, and I am not the person to write it, as I was only at the very edges of it. Suffice it to say it was driven by luminaries of the microwave field, such as Doug Rytting, Bruce Donecker, Mike Neering, Wayne Cannon, John Barr, and many others. The marketing introduction was led by Jim Fitzpatrick, who was the product manager for microwave network analyzers at the time, and was a perfect fit for the task. Indeed, he was in his mid-40's at the time, and it seemed like his entire career had been leading him up to this one great moment.

From the first NPI tours, we got consistent feedback that many customers did not need the 26.5 GHz upper end that the 8340A source and the 8515A test set offered, or its hefty price tag. What they wanted was a lower-cost system that only went to 20 GHz. Bill Wurst stopped by my desk to tell me this, and said I should begin thinking about a 20 GHz version of the 8340A. So I had some discussions with Manufacturing about the feasibility of “binning out” the microcircuits that only went to 20 GHz to potentially create a lower-cost source.

A couple months later, Wurst stopped by again. Here is our complete conversation:

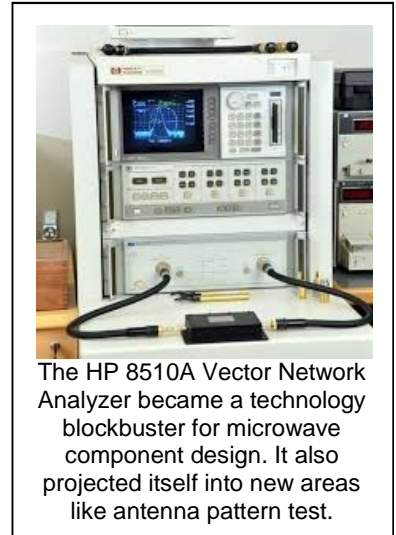
Wurst: “So, you know we've been talking about a 20 GHz version of the 8510.”

Me: “Yeah.”

Wurst: “So, I think we're going to go ahead with that.”

Me: “OK. What do you want me to do?”

Wurst: “I want you to take the chrome fenders off the Cadillac and call it a Chevy.”



And then he walked away! So I did what he asked. It was a Friday, so I took home an 8340A data sheet and marked it up over the weekend, to create a new 20 GHz source which I called the 8341A. On Monday I opened up one of the demo units and replaced the APC-3.5 output connector with a Type-N connector. I got the pubs guys started on artwork for a new dress panel that would show the new model number and frequency range. By the end of the week, we were doing a photo shoot for the new product, and the R&D team was spun up to do the appropriate firmware modifications.

The Manufacturing team began working on how to bin out microcircuits for 20 GHz operation. Meanwhile, the network analyzer R&D team began working on a version of the 8515A test set that only went to 20 GHz. The whole effort went very fast. As I would learn several times over later in my career, the key element in making a project go fast is *clarity* – i.e. when every member of the project team is crystal-clear on the objectives we are trying to achieve, there's a pretty good chance of making the project go very fast.

From time to time I also think back on that discussion with Wurst. This was a major strategic decision for the entire division, and yet he had put it in motion in the span of 20 seconds. Was it really good management or was it really sloppy management? I believe it was the former. There had been plenty of discussions about this for the prior two months, and a clear consensus had emerged (see the remark on clarity above). Furthermore, because of all of his Wiltron-related visits to my desk over the years, Wurst knew that I understood his thinking. And the HP style of Management by Objective had been so ingrained in him that he felt he could just state his objective and then walk away. So that's what he did.

As we began shipping 8510A systems, NMD became the largest Test & Measurement division. In fact, the only division that even came close to our size was our compadres in the next building, the Signal Analysis Division.

The 8510A and its follow-ons had a 20-year run in the marketplace and generated over a billion dollars in revenue. I was involved with the 8510A – either selling it or managing it – for 15 of those 20 years. And not only did I help introduce it, but in an odd twist of fate, in my capacity as the R&D manager for the Component Test Division in 2004, I led the checkpoint meeting to discontinue the 8510 family.

But it was one helluva ride for 20 years.

My Adventures in Europe

I managed the sources product line for four years, and it was so all-consuming that it seemed to go by in an instant. But I was probably due for a change, and an opportunity presented itself. Shortly after he introduced the 8510A, Jim Fitzpatrick had moved to Scotland to replace Lorenzo as our European product line manager. The joke was that he wanted to get away from Santa Rosa before all the bugs in the 8510A firmware were discovered! But off he went, and by 1986 it was about time for him to return. Scott Wright asked me to replace him, and Kirt Kisling would go along with me as a sales support engineer. But unlike past employees, we would not be based in the factory in Scotland. Instead, we would be based in a new Test & Measurement Marketing Centre that would be in Amsterdam, Netherlands. Amsterdam had been chosen because of its excellent airport and its central location. That turned out to be the case; you could get almost anywhere you needed to go in Europe with a flight of about an hour.

Our Holland adventure had a rough start. My wife Denise and I took a preview trip to find a place to live, and neither of us dealt well with the jet lag, and we got lost at least twice a day. This was not the thing to do in Holland, as we learned the Dutch drivers have a very low tolerance for drivers who don't know what they're doing, and of course when you're lost, you truly don't know what you're doing. So we had a lot of horns honking at us. But we finally found a wonderful house in a tiny village called Blaricum, about a 30-minute drive from the office.

After the preview trip, HP made us attend a series of orientation classes, on what to expect from our foreign service assignment on topics like "culture shock," taxes, housing, medical care, and even what to expect when we returned home. I can't say enough good things about how valuable this training was, because pretty much everything they said would happen, did happen, and it was really helpful to know why!

Our rough start continued a few days after the training concluded, when I was playing lunchtime basketball and injured my knee. This was 10 days before our move date. I ended up on crutches and wasn't much help in getting things packed up for storage or for the move. I was similarly useless when we arrived in Holland. And I was only home for a few days before I had to leave on five weeks of travel for our big annual microwave symposium. It was arduous travelling around Europe and Israel on crutches; thank goodness I was still relatively young and in shape.

On the home front, things went even worse. Denise slipped down the stairwell in our house and sustained a herniated disk. The Dutch have a homeopathic tradition of medicine, and so her doctor prescribed two weeks of bedrest. They even brought in a caregiver to watch our son Mike, who was not quite three years old at the time, so Denise could stay in bed. Amazingly, the bedrest worked, and just as Denise was recovering, Mike came down with pneumonia. This time even the Dutch homeopathic approach had to yield to some good old fashioned antibiotics.

But as they say, time heals all wounds, so eventually we all got better; we survived the culture shock the orientation classes had warned us about; and my travel settled down to mostly mid-week sorts of trips. But the whole time I was there, I did quite a bit of travel; we used to joke with our friends that Denise and Mike lived in Holland, and I just sort of dropped in now and then.

EEsof Acquisition

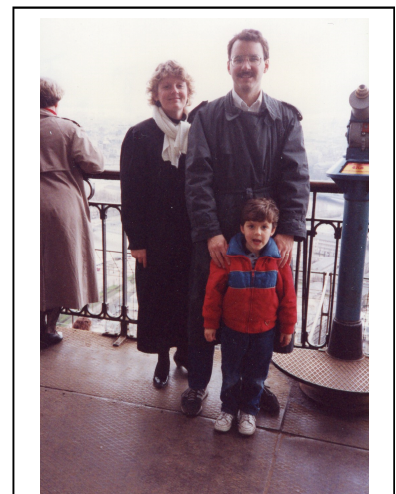
On the business front, there was trouble almost from the start. A few months after I moved to Holland, NMD announced they were



Houses in downtown Amsterdam right next to one of the canals. Although this picture is from 30 years ago, it probably still looks the same.



Son Mike in some wooden shoes he clearly needed to grow into. This photo was taken early in our stay in Amsterdam, so he was about three years old at the time.



Denise, Mike, and I on a foggy day at the Eiffel Tower. This photo was taken near the end of our stay in the Netherlands.

acquiring EEsof, a firm that made microwave design software. We had launched our own effort to create this kind of software, and apparently the decision was made that we could reach our goals more quickly if we added in this acquisition. Shortly after the announcement, I attended a big trade show where both HP and EEsof (the acquisition was still awaiting approval) were exhibiting. I went over to the EEsof booth to introduce myself, and quickly discovered that while the founder, Chuck Abramson, thought this deal was a good idea, none of his lieutenants did, and they made it *really* clear that HP – and I – were an unwelcome intrusion. Then I found out our European sales force was strongly against the deal as well. Opinions ranged from “this is a dumb idea” to “we won’t sell it. We only sell hardware.”

As if I hadn’t already stepped on enough land mines, I dutifully went back to the office and wrote up all that I had learned, and sent it off to a pretty long list of people back in Santa Rosa. Well, you could hear the howls all the way across the Atlantic. Apparently, it had become “politically incorrect” to criticize the acquisition; although I was not criticizing, just reporting. But that didn’t prevent several calls to shoot the messenger. Fortunately, I nominally reported to Scott, and he had a more clear-eyed view of what was going on. And I’m happy to say that once everyone got past the emotion, we were able to begin to address the real issues of what it meant to be in the design software business.

Discounting was another problem. In the U.S., our presence on the GSA schedule put a floor on how much discounting you could do. Of course, in Europe, there was no equivalent, so we got into a lot of price shootouts. Here again, I lucked out – Scott spent a lot of time with me on the phone so he could imbue in me his approach to discounting. We worked through many different sales situations during my first several months in Amsterdam, and then when he was sure I “got it,” he turned me loose with some guidelines on what I could authorize on my own, and when I should call back to the factory for additional approval.

And none too soon. Wiltron introduced the 360A network analyzer, a direct competitor to the 8510A. At this point our field sales team had enjoyed nearly three years of selling 8510A’s without any competition whatsoever, so, to put it mildly, they were thrown into a bit of a panic. Kirt and I both found our jobs drastically changed after the introduction of the 360A. Wiltron was determined to get a foothold in Europe, and they had some very aggressive reps. So we got into a competitive battle almost every day, and we did some deals that would have made even the most aggressive electronics retailers blush. But we held the line. We finally lost when the Wiltron Israeli rep told his customer that whatever HP charged for *one* 8510A system, he would charge that same amount for *two* 360A’s.

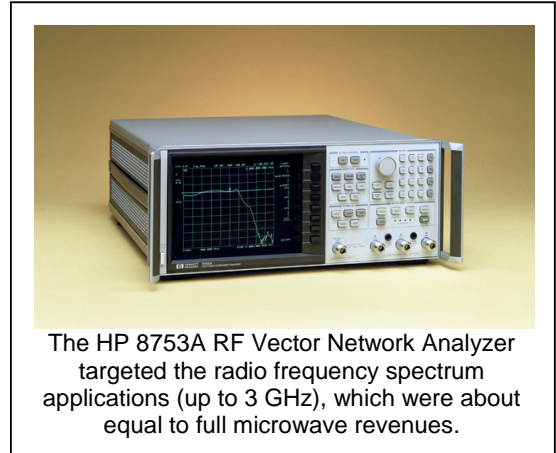
Our biggest problem was in Germany. It was a huge market; Wiltron had an aggressive rep; and the German sales guys weren’t particularly strong at mixing it up with the competition. Back in Santa Rosa, we had a young guy named Phil Lorch who spoke perfect German and was technically strong. Scott sent him off to Germany with one assignment: win all the battles against Wiltron. The “Rambo” movies were all the rage at the time, and Phil was so successful at wreaking havoc against Wiltron that Kirt and I took to calling him “Philbo.” Of course, in retaliation, he began calling us “Kirtbo” and “Stevebo.” Thirty-plus years later, whenever we meet, we still call each other by those names. I guess some idiocies you never outgrow.

The HP 8753A

Kirt and I had another thing keeping us busy: the 8753A RF vector network analyzer. This product was intended to replace the 8505A RF network analyzer that had been around since 1976, and it was nearly as big a revolution in the RF world as the 8510A was in the microwave world. Furthermore, it had a first-rate marketing introduction being led by Lorenzo, who had

become the RF network analyzer product manager when he returned from Scotland. They even had a cool tag line: “champagne measurements on a beer budget.” It was a very important NPI for us, because, proportionately, RF was a bigger part of the European market than it was in the US. The only problem: we couldn’t ship the damn thing! So I fielded *lots* of angry calls from the sales team about where the hell is the 8753A. Lorenzo sympathized, but really couldn’t do much other than wait for the software and QA work to be finished, and promise it would be worth the wait.

He was right. When we finally did start shipping, the 8753A rolled over Europe like a tidal wave. Customers loved its simplicity, its accuracy, and its price point. Three stories stand out. The first occurred when I was in South Africa, demonstrating how the 8753A’s time domain capability could be used to measure an important SAW device parameter called triple-travel. “You know,” said a customer. “I’ve been working on a SAW device and I’ve been unable to measure triple-travel. Do you think this could do it?” When I said yes, he replied, “Well, I’ve got one out in my car. Can I go get it?” “Sure,” I said. He came back with his device, and sure enough, we were able to measure triple-travel just as I had described. His jaw dropped. And without even a hint of irony, he looked at me and asked, “Is there *anything* this machine can’t do?” “No,” I smiled. “There isn’t. How many would you like to buy?”



The HP 8753A RF Vector Network Analyzer targeted the radio frequency spectrum applications (up to 3 GHz), which were about equal to full microwave revenues.

The second story comes from Italy, where we were exhibiting at a trade show. We had the 8510A and the 8753A next to each other, and the (naturally) unruly Italian customers were in a sort of scrum to get close to either of them. Silvano Bellemo, the country marketing manager, and I were standing back a bit, observing this. After about a minute, Silvano said, “You know, Steve, I think NMD should make all Test & Measurement products.” “I think you’re right,” I said, and then we both busted up laughing, before diving into the scrum to try to restore some order.

But my favorite 8753A story happened in Helsinki, Finland. I was on a phone call with Scott, and when I mentioned I would be traveling to Helsinki, he had a request. “Hey, while you’re there, find out how they’re selling so many 8753’s. I’m worried some of them might be ending up across the border with the Soviets, which would obviously be a violation of our export license.” Well, it took a lengthy drinking session with the sales guys that wrapped up around 3 am, but I got my answer. The 8753’s were all safely in Finland, and being sold to a company called LK Products, who were using the 8753’s to test a huge number of diplexers. They were selling these diplexers to a company I hadn’t heard of before, an outfit called Nokia. Nokia was putting the diplexers into a product I had barely heard of before: cellular telephones. It was my first brush with a market that would totally consume me for most of the 1990’s.

By mid-1987, things were going pretty well. We had managed to blunt Wiltron’s impact, the 8753A was selling well, and Kirt and I had Europe growing quite a bit faster than the overall NMD growth rate. But we had one more trick up our sleeve, a product called the 8720A. It shared several characteristics with the 8753A: it had essentially the same front panel, an integrated source, and an attractive entry price. But its upper frequency range was 20 GHz, so it was a true microwave network analyzer. In essence, it was the little brother to the 8510A, but unlike the 8510A, we had kept this NPI under tight wraps. So when we launched it, the field was simultaneously stunned and overjoyed, because now we had the Wiltron 360A surrounded. If

you wanted the best there is, you bought the 8510A. If that was more than you could afford, no need to consider Wiltron, you just stepped down to the 8720A. It sent Wiltron reeling, because they never saw it coming, and they had no counter. It was one of the most fun introductions I ever took part in.

It is hard to put into words how the European assignment changed those of us fortunate enough to have the experience. For one thing, we learned there is no “European market,” as people in the US frequently referred to. There was a French market, an Italian market, a German market, and so on. Each was unique, and what worked in one might not work in another. On a deeper level – and again, our orientation classes told us this would happen – there was the realization that the U.S. is not the center of the universe, that “the American way” is not always the best way, and that there are in fact many legitimate viewpoints on most issues. I should add the experience was not all one-way. For example, when one of our office-mates changed jobs, Kirt and I introduced the concept of “roasting” them as part of their farewell. Roasts were a long-standing tradition in Santa Rosa, but unheard of by our European friends until Kirt and I showed them what it meant. I’m pleased to say they embraced the idea enthusiastically!

With the benefit of 30-plus years of hindsight, I’d have to say the thing I’ll remember most about my time in Europe is the people. All of our office-mates in the Marketing Centre were outstanding to work and travel with, and my boss, Bill Risley, was just great to work for. Among the field sales teams, I was particularly close to Rey Rosenberg and his band of microwave experts in the UK. Rey and I had many good customer visits together; one of our favorite destinations was the University of Leeds and the excellent microwave program that Prof. Roger Pollard was running there. Rey was trying to recruit one of Roger’s doctoral candidates, Mark Pierpoint, into the sales force. He was ultimately successful, and Mark rose to become the president of the Ixia group after Keysight acquired them in 2017. Roger himself spent 20-plus summers coming to Santa Rosa and working in the network analyzer lab, making many contributions to microwave measurement science.

Kirt and I both had close relationships with the Benelux sales team, partly because of proximity and partly because we both developed a deep respect for the Dutch people and their culture. We also were close with the Israelis – the sales guys were all unique characters, and besides, you just had to respect people who were trying to hack a modern nation out of the desert.

All things considered, living in the Netherlands was a great experience once we got past the initial rough patch, and Denise loved it even more than I did. In fact, after we moved back in 1988, she spent the next ten years asking if I could find another assignment in Europe.

The Antenna Test Team

When I returned to Santa Rosa, Bill Wurst asked me to lead an “experiment.” A lot of customers around the world had been using the 8510A to make antenna pattern measurements. This made a certain amount of sense, as the measurement was just a straightforward S_{21} (the transmission scattering network parameter) measurement, with the only twist being that the transmitted signal arrived over the air, rather than through a coaxial cable. And by rotating the antenna through azimuth and elevation, you would get a complete picture of its pattern. Similarly, other customers were making Radar Cross Section (RCS) measurements, which is a measure of how “big” an object looks to a radar system. Again, this was a straightforward S_{11} (reflection) measurement, with the reflected signal arriving over the air. NMD had even written a well-received application note on using the 8510A to make these two measurements.

But Wurst believed there was a bigger play here; an opportunity to offer a complete system rather than just an application note, and even to build a new product line around these measurements. But because it was a system, and because it would include a lot of software and major pieces of hardware that we would get from third parties, he felt the traditional demarcation between marketing and R&D would not work. He wanted an integrated team to focus on just these applications, and he asked me to lead it. I would report directly to him. Click [HERE](#) for our HP catalog page description.

I should say that Wurst's view on how to approach this was not universally shared by NMD management; particularly in R&D. There were influential managers who felt this integrated team was a bad idea, and they were not shy in telling me this. Nevertheless, off we went to see if we could make this work.

On the R&D side, I had John Boyles as my project manager. John had a good background in these measurements, having written most of the app note. And he was experienced in front of customers, having honed this skill by being the world's expert on the 8510A's Time Domain capabilities, when we had launched the 8510A four years earlier. John had three R&D engineers reporting to him. On the marketing side, Greg McCarter was the product manager, and he also had a strong background in the measurements. He had two marketing engineers reporting to him.

We had several problems to tackle: 1) the 8510A did not have a "clean" way to synchronize its measurements with the positioner that turned the antenna or RCS target; 2) we had no software to control the entire system; 3) we had no local range to make measurements; 4) there was an entrenched competitor, Scientific Atlanta, that had dominated this market since the late 1950's; 5) Our sales team was not used to selling complete systems, and definitely not used to selling products (such as positioners) not made by HP; 6) HP did not have a very high profile within the antenna test / RCS community, despite the recent popularity of the app note.


So we had our work cut out for us! The software seemed like the longest-timeline item, so John put two of his engineers to work on this. Then we hired an Israeli engineer, Baruch Cysz, to do the needed modifications to the 8510A. Baruch was on a one-year sabbatical from his firm in Israel, and he turned out to have just the right skills needed for this work. He was a great find for us.

On the marketing side, the entire Santa Rosa site had been built into a hillside, so we knew an outdoor antenna test range was going to be impractical. Instead, we got approval to build an indoor Compact Antenna Test Range (CATR) in Building 3L. Greg and one of his engineers, John Swanstrom, did most of the work in creating the specs for the CATR, with help from John Boyles. A CATR gets away with its small size by using reflectors which shape the antenna's wavefront to be essentially planar (just as it would be on an outdoor range and in actual operation) within a small area in the chamber called the quiet zone. The problem was that the reflectors were *very* expensive. Fortunately, Greg had some contacts within Hughes Space &

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Antenna & Radar Cross-Section Measurements

Antenna/RCS Measurement Systems, 45 MHz to 110 GHz



HP 8510B is the RCS measurement system of choice for HP associated test ranges.

- Operates in the range of 45 MHz to 110 GHz
- Fast to setup, start of production in 10 days
- Excellent measurement accuracy and stability
- Choice of automated or manual data acquisition
- Choice of manual or automatic data acquisition

HP 8510B is the RCS measurement system of choice for HP associated test ranges.

HP 8510A Microwave Receiver

The HP 8510A is a fast and accurate receiver used for radar and for both manual and automated RCS measurements and radar cross-section measurement applications. It features fast data acquisition speeds, manual or automatic data acquisition, and excellent measurement accuracy. The receiver provides broad frequency coverage from 45 MHz to 26.5 GHz, with a maximum 110 GHz.

Easy Upgrades for Existing Antenna Ranges

The HP 8510A microwave receiver can be a replacement receiver for existing antenna ranges. The HP 8510A receiver can be interfaced to virtually any existing system. Also, the HP 8510A receiver can be upgraded to an HP 8510B microwave receiver and all related software, control, and test equipment. The HP 8510B receiver provides a wide range of receiving and transmitting capabilities. Whether you require one component or a complete system, HP provides the flexible instrumentation you need, and it's upgrade paths provide your investment in your test equipment system.

Customized Systems to Meet Your Requirements

The HP 8510B measurement system is available in 10 standard configurations. HP offers a variety of options to extend the capabilities of the system and to meet your specific requirements. HP has microwave systems designed to meet your specific requirements. HP has microwave systems designed to meet your specific requirements. HP has microwave systems designed to meet your specific requirements.

Ordering Information

HP 8510B Antenna/RCS Measurement System
HP 8510A Microwave Receiver
HP 8510B Antenna/RCS Measurement System
HP 8510A Microwave Receiver

Please call your local sales representative for detailed information about these and other HP products.

The HP Catalog page describing the Antenna and Radar Cross Section Test System. Its computation algorithm and data acquisition meant that the measurements could be housed in a normal building instead of an outdoor range of some hundreds of yards.

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Comm, and he learned they were closing down one of their CATR's. So we got approval from Finance to arrange a swap: some of our mm-wave measurement gear for the reflectors.

We also made two other important decisions on the marketing side: 1) we would cast the 8510A modifications that John and team were working on as an entirely new product, the 8530A antenna measurements receiver. This would make it tougher for Scientific-Atlanta to portray us as not being really serious about the market. 2) We would raise our profile in the market by having a major presence at the AMTA (Antenna Measurement Techniques Association) conference each year. This was a small conference with only a few hundred people attending, but it was the *right* few hundred people, so we wanted to have a pretty big footprint at the event.

We also began building relationships with key third parties. For a specialized sub-application called nearfield measurements (measuring the wavefront before it becomes planar, and then mathematically converting the data), we worked, appropriately enough, with a firm called Nearfield Systems, Inc (NSI). Nearfield measurements had originally been developed by the U.S. National Institute for Standards and Technology (NIST) in Boulder, CO, and had the benefit of not requiring an outdoor test range or even an indoor chamber. NSI had commercialized this technology. For regular far-field measurements we worked with a few firms, but the one we worked with most often was a firm called Flam & Russell, located just outside of Philadelphia.

As our work progressed, it became clear that the 8530A was going to make a real contribution to the market. It also became clear that our system software, even once it was finished, was going to need a burdensome amount of resources (for a small product line such as ours) just to support, maintain, and enhance the code. So I visited Rick Hartman, the EVP at Flam & Russell, and the two of us struck a deal. We would jointly market a system that used their positioning subsystem and their measurement software, and our measurement hardware. This allowed each company to focus on what it did best.

But not many people saw it that way at first! When I told my team what I'd done, they were *really* upset with me. Similarly, when Rick told his team what he'd done, they were really upset with him. Comparing notes on the phone, we realized that it must be a pretty fair deal, because it pissed off both sides equally! And ultimately it did turn out to be a good deal for both firms – we successfully sold a lot of these systems to the customers who were not “do-it-yourselfers.”

When we first got into the market, we tried to compete with Scientific-Atlanta by simply trading on the wonderfulness of the 8510A platform, and contrasting it to SA's older gear. This was only partially successful, because SA had some things we didn't – they were a true one-stop shop, and they had a long history in the market. But as we gained experience, we learned that not only was the SA gear older, but sometimes it would “lose sync” with the positioner moving the turntable. This was a much bigger hammer for us to use – doing a complete pattern often took hours, and time on any antenna range was a valuable commodity, so the last thing you wanted to do was have to repeat the entire measurement.

We also learned that the SA equipment couldn't measure input VSWR of the antenna, a critical parameter in almost all applications. Of course, *we* could measure it, because VSWR is just another name for S_{11} , and we had a network analyzer as the heart of our system. But I was dubious about this, because no one measured VSWR on the range – they measured it back in the lab on the bench. But as we learned by listening to our customers, that wasn't the point. The point was it made it easier for them to provide the justification for buying new equipment for their ranges. So once again I had to re-learn the ancient marketing maxim that “customers buy for their own reasons.”

Ultimately, we wrapped our modernity, reliability, and versatility in a single message: “Performance you can depend on.” This messaging, combined with our partnership with Flam & Russell, proved to be a winner. Within about 18 months, SA’s 30-year dominance of the market crumbled. That was much faster than I would have ever predicted, and I guess it shows the market was ripe for a change.

In the end, however, the antenna test “experiment” was only partially successful, because while we had gotten the business to over \$10M, we had been aiming for more like \$25M. Undoubtedly the biggest reason for this was that as defense spending slowed down in the late 1980’s, the RCS market got a lot smaller. But we had learned some valuable skills along the way – how to work with third parties, how to tailor our system to meet each customer’s need, and how to sell and support an entire system, rather than just a “box” instrument.

The Incremental Business Team

By the end of 1990, things were going pretty well in antenna test, although there was still much left to do. Inside the rest of NMD, people were searching for ways to grow, as spending in the traditional aerospace / defense market had slowed considerably after the Berlin wall came down and the Soviet Union collapsed. One of the growth efforts came from a group of folks providing customized systems for a variety of microwave applications. They had started within the division’s Special Handling group, and as they found some success they sort of evolved into a separate group called the Incremental Business Team. They were led by Steve Schultz, an R&D veteran who was a well-known maverick.

Bill Wurst could see the IBT was struggling with many of the same issues as the antenna test team – how to sell systems, how to support them, how to customize them, etc., all without going broke in the process. So he asked Schultz and me to combine our efforts. Antenna test would continue as just another system being offered by the IBT. Schultz and I would both report to Irv Hawley, NMD’s R&D manager, and we would also have a “strong dotted line” reporting relationship to Sam Scott, the NMD Manufacturing manager. This made sense because up until this point, the IBT had been part of Manufacturing.

In my opinion, Irv Hawley had been a major influence on HP’s success in spectrum analyzers. His list of contributions was long and impressive. When the Santa Rosa Division split in 1980, I guess he decided, “been there, done that,” and became the R&D manager for network analyzers, where his lab churned out the 8510A, the 8753A, and several other blockbusters. He was truly one of the giants in the history of HP microwave & RF products. Irv was famous for falling asleep in checkpoint meetings, then suddenly waking up and asking some insightful question to the presenter. He also walked around most of the time with his shirt half-tucked-in and half hanging out. In short, he gave every impression of being a mad scientist, but that was only part of the picture. He was also a very good people manager. You could tell him anything, no matter how pissed off or irrational you were feeling, and he would listen, and more often than not, had some good suggestions on what to do.

Sam Scott had spent his entire career in manufacturing, and he came across as a plain-spoken Okie. And in fact, he really *was* from Oklahoma! But his persona belied the fact that he knew manufacturing inside and out, and in fact he had a grand vision for NMD Manufacturing he called “the factory of the future,” which he pushed at every opportunity. This sometimes led to tension with Wurst, who, as the general manager, was naturally more concerned with this quarter and next rather than five years out, and who had limited enthusiasm for large CapEx expenditures. Whenever Sam pushed too hard, Wurst would retort with, “Sam, before we have a

factory *of* the future, let's make sure we have a factory *with* a future." It was all pretty entertaining.

So Schultz and I dove in to add our own twist to this cast of characters. We had known each other before this assignment, but not well. It turned out we had very complimentary skill sets. Schultz was "Mr. Inside," adept at working the various manufacturing and development issues we encountered daily. I was "Mr. Outside," dealing with the sales issues, marketing, and with the recently formed Test & Measurement Third Party Supplier program. More interesting was that when we came under pressure (as frequently happened in the systems business), our personality characteristics changed, but we were *still* complimentary.

Ordinarily, Schultz came across as this brash, in-your-face, let's-roll-the-dice-and-see-what-happens kind of guy. But under pressure, you learned that he actually did care what you thought of him, and he was more risk-averse than you might imagine. And me? Well, I was usually the more diplomatic and measured one, but when the pressure ramped up you learned that I was going to do what I thought was right. I didn't really care if you liked it or not; and I also understood the maxim of "no risk, no gain," so I was sometimes viewed as a bit of an unstable element in the conservative T&M culture.

Schultz and I were both self-aware enough to observe and realize all of this, and to understand that it made us a strong team. So while we did have areas we focused on, the truth was we discussed almost all big decisions with each other before acting. Once again, my streak of having just the right people to work with at just the right time in my career continued unbroken.

One of the first things Schultz and I did was to go to Irv and tell him that when annual ranking rolled around, we wanted to be ranked together. In other words, if Schultz was going to be ranked a "three," I would be a "three" also. Initially, Irv was not a fan. "Why do you think this will work?" he asked. "Because it worked for two other guys named Hewlett and Packard," we replied. Well, Irv said, he had to admit we had him on that point, so he reluctantly agreed. It may seem strange that something like this was high on our to-do list, but I believe it was because Schultz and I both instinctively (at first) understood that success in the systems business required a much higher level of collaboration than it did in the traditional instrument business. So it was important the reward system reinforced the view that we were all in the same boat.

Another thing we started right from the beginning was a regular Monday morning meeting at a place near the office called "Café des Croissants." I would drop my kids off at school and meet Schultz there around 8:30, and we'd spend an hour or two discussing what we had to do that week, and also doing a sort of post-mortem on the previous week. Because we were off-site, we could accomplish this without getting interrupted every 10 minutes with the latest crisis. These meetings were very useful, especially the post-mortems. Often we'd find that as a team we'd made so many mistakes we almost couldn't track all of them. On the one hand, we'd marvel at why we hadn't been disbanded after so many screw-ups; but on the other hand, we knew why: we were getting some growth for the division. We were finding new uses for our equipment, and we were learning a lot. It really is true: you learn a hell of a lot more from your mistakes than from your successes.

These Monday meetings also gave us time to get aligned, so we could present a "unified front" to Irv or Sam or any other member of the NMD management team, as well as to our people. This was important, because the people working in IBT knew they were doing something new and different, which of course meant somewhat higher risk. So it was vital they have confidence in the guys running the team. And finally, these meetings gave Schultz and me a safe space to vent

– sometimes at each other, but usually at someone in the division who didn't quite “get” what we were trying to do.

Besides antenna test systems, we came up with a few other systems that found some market success. One of these was the Single Connection, Multiple Measurement (SCMM, pronounced “scum” or “scam,” depending on how you felt that day) system, which was used to test the individual elements that made up a phased-array antenna. These elements required exhaustive testing, and our system made a big contribution in overall measurement throughput. We also made a system that measured high-powered devices which could only be tested under pulsed conditions, which created a lot more measurement problems than you might first imagine. (The normal CW mode of measurement would burn out the component.) Another of our systems spit out the data used to create device models used by microwave design software, including HP's own MDS. Still another one, which was very complex, was used to do ground testing of satellites before they were launched.

All of these systems needed lots of software to do their jobs; all of them had major hardware and/or software elements that came from third parties; and all of them were customized to meet individual customer needs. From this came our first attempts at establishing a program management function, and documents like statements of work, change orders, and configuration guides. And we began to develop relationships with third parties, and to build a network of contractors we could use to provide specific skills we didn't have, or needed more of. We also spent a lot of time trying to adapt our finance systems, which were very instrument-centric, to this new kind of business. We weren't always successful!

Overall, the two-plus years I spent working with Steve Schultz in the IBT was a tremendous experience. We learned new things almost daily, we had success in the market, and we worked with a bunch of first-rate people who were really pumped up to show that a 50-year-old instrument company could still learn new tricks.

Most of the other T&M divisions were also launching some sort of IBT-style effort for their product lines, for the same reason we'd launched ours – to try to get some growth back into the division. We didn't know a lot about what they were doing, but from the meetings I attended on the T&M Third Party Program, we gained a sort of vague impression that we were somewhat larger and more successful than the other efforts. We soon learned we were correct.

The Santa Rosa Systems Division

Dick Anderson had a distinguished career with HP. He had started in microwave, then gone off to the computer group and led some of HP's early successes in computers. In the mid-80's he returned as the head of all of HP's RF & microwave divisions. Dick was many things, but one thing he was for sure was a visionary. In the early 90's, he saw each division trying to build a systems capability, and each one struggling with the issues of doing that. He also believed very strongly that *communications* – in the form of cellular telephones – would be the driving force for RF & microwave in the 1990's, rather than aerospace/defense, which had driven us in the 1980's. He also felt that the cost of bandwidth was dropping so quickly, that it would essentially become free, creating an explosion in broadband communications.

Dick thought the microwave divisions were poorly organized to exploit any of these trends, so he acted. In March 1992 he undertook a massive reorganization of the Microwave Group. He created a Lightwave Division, which would take all of the optical instrument projects from the various divisions and put them into one organization that would focus on the expected explosive growth in broadband communications. The Spokane Division would focus exclusively on the

manufacturing test of cell phones, and its other product lines would go elsewhere. Dick also created a new Microwave Instruments Division (MID), which would focus on the large part of our business that wasn't changing. MID had all of the traditional power meter, signal source, spectrum analyzer, network analyzer, etc. product lines. Finally, there would be another new division called the Santa Rosa Systems Division, which would consolidate all the systems efforts from the various divisions, so we only had to learn new lessons once, instead of in every division.

Perhaps the most controversial aspect of Dick's plan was that R&D budgets would be funded on opportunity, not on revenue base. For decades, the microwave divisions had been run with R&D budgeted at about 10% of revenue, so if you grew revenue, you could grow R&D. No longer, said Dick. Divisions with clear market opportunities, such as Lightwave and Spokane, would be funded at a higher rate, while MID – where most of the product lines were already dominant – would be funded at a lower rate. It's hard to overstate how much angst and hand-wringing this produced in a culture where spending 10% on R&D was taken as a birthright, and where new products were viewed as the lifeblood of the organization. The MID rank and file took to assuming they were doomed, and the only question was whether it would take two years or five years.

The week before Dick rolled out all of these changes, I had been on a campus recruiting trip at my alma mater in Cleveland. It had been a very long day, so when I got on the plane to fly back home, I was pretty drained. The plane had those credit card-activated phones in the armrests of the seat, like a lot of planes used to have, until cell phones took over. I'm too tired, I thought. I'll just check voicemail tomorrow when I get in the office. But then, since takeoff had been delayed, I figured, what the hell, I don't have anything else to do.

Good decision. There was a voicemail from Dick Anderson's assistant saying Dick was going to be in Santa Rosa the next day, and wanted to meet with me first thing in the morning. So I showed up the next morning sort of jet-lagged, and found the meeting was in a windowless conference room in 2-Upper that I'd never been in before. It looked like something straight out of the Ministry of Love from George Orwell's *1984*.

"Uh, nice digs you've got here, Dick," I said. He chuckled and said he thought this was the room HR used when they had to fire someone.

"Is that why *we're* here?" I asked, only half-kidding. I was frequently in trouble with Corporate (Or, "Galactic Headquarters," as everyone in Santa Rosa called it), usually because some number in one of my monthly reports didn't match some other number they got from some other source, when it was supposed to. That happened a lot, because, as I noted above, the financial reporting systems weren't exactly optimized for our kind of business.

"No," he said, smiling. Then he described the reorganization he was planning. He talked about why he was creating the Santa Rosa Systems Division and his vision for it. Scott Wright would become the general manager, and Bill Wurst was going to retire. Dick asked me to be the SRSD marketing manager, and I accepted.

And just like that, when Dick rolled out the reorganization about a week later, I was in charge of over 100 people and several product lines, most of which I had no previous experience with.

Indeed, complexity was the biggest initial hurdle for SRSD. From NMD we inherited all of the IBT efforts, as well as the 8510. The 8510 only did one thing, network analysis, but it was a complex system, so it landed with us rather than in MID. Similarly, we inherited the Modular

Measurement System (MMS) from Signal Analysis, even though at the time it only did spectrum analysis. This was not for lack of trying – at the time SRSD was formed, I discovered an astounding *nine* full-time product marketing engineers working on MMS. Even at its peak, the 8510 never had more than five PME's. SAD also contributed the Electromagnetic Compatibility (EMC) product line, and a giant avionics test program they were doing for the Navy, called CASS. From Spokane we got the phase noise measurement product line. From Stanford Park we got the Frequency Agile Signal Source (FASS), as well as the Microwave Test Accessories (MTA). This last one was a bit of a head-scratcher, as MTA was attenuators, adapters, couplers, etc. But it landed in SRSD because almost every system we made had a customized switch matrix, made almost entirely of components from MTA.

The 8510, MMS, FASS, CASS, phase noise products, and most of the IBT systems all shared the same problem – they were all aimed at the aerospace / defense market, a market which had been basically flat for the past few years. John Vink, our newly-named R&D manager, laid out a process to help us break out of this box. We got pretty much all of the managers in SRSD, and many of the senior individual contributors together for a brainstorming session on potential markets. We came up with about 40 possibilities. We then held a separate session where we cut this number roughly in half just by discussion and taking advantage of what various people in the room already knew. Then we split up the group into teams of 3 to 5 people, with the caveat that team members had to come from different functions, i.e. if a team had three people in it, only one could be from Marketing, one from R&D, etc. Each team took one or two of the remaining 20 or so ideas to investigate further, and we had a list of characteristics we wanted to know about each market, so we could make accurate side-by-side comparisons. For example, we wanted to know how big the market was, how fast it was growing, who were the incumbent players, etc. The teams had limited time – about three weeks, as I recall – to come up with this information.

With the data gathered, we held a big meeting to review what the teams had found. Three pretty clear winners emerged: 1) Computer-Aided design for microwave designers. But of course, we were already pursuing this, so the study just validated that we'd made a good choice. 2) Signal monitoring – with the rise of cellphones, we saw two possibilities. One was systems that would go into a van, and map the strength of a carrier's cell tower coverage as it was being driven around. The other was a combination of fixed and mobile systems that would monitor cellphone traffic for compliance (things like signal strength, overmodulation, frequency usage, etc.) over large areas, even entire small nations. 3) Radio Frequency Integrated Circuits (RFIC) testing. This was also driven by the rise of cellphones. As their volumes went up, their designs would have to transition from discrete transistor-based RF circuits, to designs that put the RF circuitry into IC's. Otherwise the cost reduction and size reduction goals that the cell phone makers had in mind would never be achieved. Traditional IC test companies such as Teradyne and LTX knew nothing about the world of RF measurements, while we knew pretty much everything.

So the plan was set. Vink's R&D lab would work on these opportunities, and in the meantime SRSD would generate revenues from the inherited product lines such as the 8510 and from the ongoing IBT efforts.

If only it had worked out that way! Almost immediately, a sort of “cold war” broke out between the engineers working in the IBT (which was now reporting to Sam Scott), and Vink's R&D engineers. The former group thought they should be getting the lion's share of the resources because they were keeping SRSD going, while the “ivory tower” R&D folks were doing whatever the hell they were doing. The R&D folks, on the other hand, thought *they* should be getting most of the resources, because their work was the key to a profitable future. In marketing, meanwhile, we were getting pulled by both of these teams to support them, while also trying to

keep traditional product lines such as the 8510, MTA, and phase noise relevant to the field sales team.

A more insidious problem also crept in: in SRSD, our people would wrestle with unfamiliar issues such as program management, statements of work, configuration guides, customized software, and an increasingly complex network of third party suppliers. In the IBT, we had taken initial stabs at these topics, but we certainly hadn't completely solved them or figured out how to scale them up. So almost every day, our people would face new, confusing, and often frustrating topics.

Meanwhile, just 30 yards away in the next building, their MID counterparts were getting the exact same pay and benefits to do a job they pretty much knew how to do just by rolling out of bed each morning. The company had spent the past 50+ years developing and refining how to do those roles. The result was predictable: as positions opened up in MID, we lost people to them. And MID was doing great, despite the reduced R&D budget. So was the Lightwave Division, where my old friend Lorenzo had become the division sales manager, and had them on a tear as the broadband comms market heated up. And just to add to our degree of difficulty, Scott was new in his job, as was most of his staff.

By early 1994, we'd had two years of flat growth, thinning profit margins, and a dispirited workforce. Rumors began to circulate that Scott and his entire staff would be fired within the next six months, the SRSD workforce and product lines would be absorbed by MID, and the whole idea of making systems, rather than just instruments, would be abandoned.

Then fate stepped in. Jody Edwards, our HR manager, had attended a conference and heard a talk by a Harvard Business School professor named Michael Beer. He had described a process he and his colleagues had developed that enabled organizations to self-diagnose, and then solve, their most pressing issues. Jody described this to Scott and his staff, and we figured, what the hell, we didn't have much to lose at this point, so we invited Mike to Santa Rosa. He spent a day explaining his ideas to Scott, his staff, and our direct reports. He stressed, above all, that he wasn't looking for some consulting annuity. He would teach us his methods, and even coach us the first time through the process, but after that we'd be on our own. It's fair to say Scott and his staff were a bit leery, but several of our direct reports were very impressed with what Mike had to say, and they pushed us hard to give it a try. So we signed up.

Mike's process was called Strategic Fitness Profiling (SFP). It started with a one-day meeting with the senior team, i.e. Scott and his staff. During this meeting we developed our "strategic tasks," i.e. the one or two things we *must* do to be successful. So no 60-page strategy documents; in fact, not even a half-page strategy document. Just simple statements on what we had to do. We decided we had to: 1) create new systems businesses that could ultimately grow into their own divisions; and 2) simultaneously support our legacy products and legacy market of aerospace / defense. Also during this meeting, we picked an 8-person Employee Task Force, composed of people who reported directly to us. Each task force member had to have the unanimous support of the senior team.

The task force would do the work of interviewing the SRSD employees, and then presenting the results to the senior staff. But there were several aspects of the process that were sneakily brilliant:

- 1) If a consultant gathered the data (tempting, since all of us had "day jobs"), you could dismiss what they came up with if you didn't like it, just by saying, "they don't

understand us.” But when it’s *your own people*, and *you picked them*, it becomes essentially impossible to ignore what they come up with.

- 2) The task force members were required to interview people outside of their functional area. For example, if you worked in R&D, you would not interview anyone from R&D. This minimized the chances of task force members imposing their own biases on the interview results.
- 3) The interviewees were asked only one question: “here are SRSD’s strategic tasks (as we had defined them in our one-day meeting). What prevents you from achieving them?” At this point, most employees would unload with everything they saw wrong within SRSD. Twenty to thirty-minute answers were pretty common, from what I heard. And of course, employees were guaranteed anonymity. By asking only this question, the focus was kept *on the business*, rather than personal animosities towards one or a few persons. About one-fifth of all SRSD employees ended up being interviewed.
- 4) The task force met to organize their feedback into themes they could present. This helped them understand which issues were common across all parts of the division.
- 5) When the task force presented the feedback, they sat in a circle and talked to each other, and not to us! Furthermore, the senior staff was not allowed to ask any questions. We just had to sit on the outside of the circle and listen. Both of these rules made it easier for the task force to present difficult messages, without having to worry about the senior team getting defensive.

We set up a four-day meeting offsite at the Bodega Bay Lodge. The first day would be the feedback from the task force. The next two days would be the senior team wrestling with what to do about it. The last day would be the senior team discussing their proposed solutions with the task force.

Even though we had told the task force we wanted to hear “the unvarnished truth,” I later learned from several task force members that when they organized the feedback themes and realized how negative it was, *all* of them were convinced the first day of the offsite would be their last day at HP.

And the feedback *was* really bad. If I could summarize the nearly seven hours of feedback into one run-on sentence, it would be something like this: the senior team doesn’t agree what business we should be in, no one communicates with each other, and we don’t have the right skill sets or coordination mechanisms in place to execute a systems business. Of course, in accordance with the process we’d agreed upon, we could say nothing, so I just sat there, furiously writing notes. It was easily the worst day of my 27 years at HP and Agilent.

After we dismissed the task force (and no, nobody got fired!), Mike told us that as bad as all of that was, he was certain there was enough management talent in the room to turn things around. Well, no one was in the mood for a pep talk, and I damn near lost it at that point, wanting to shout something like, “Well, Mike, if we’re so fricking talented, how did we let things get this bad?” The odd thing is, he was right, as I would learn over the next 11 years at HP and Agilent, and at several firms after I left Agilent. But I didn’t know that at the time, and so that night, in my room at the Bodega Bay Lodge, I wrote my resignation letter to Scott. We had screwed things up, and the right thing to do was to let someone else take a shot at it. I had just about finished it when I realized Scott would never accept it. He would remind me – none too gently, I

suspected – that we had agreed to do this together, we had gotten into this mess together, and we were going to get out of it together. So I tore up the letter.

The next morning, the senior team and Mike Beer walked back into the conference room. We began discussing the feedback we'd heard the day before. We were only about 20 minutes into the discussion when our first breakthrough happened. "You know," Sam Scott volunteered, "until I heard yesterday's feedback, I didn't fully understand how much pressure the custom team was putting on the rest of the organization." Sam's honesty and willingness to be vulnerable seemed to encourage the rest of us to open up, and after a much freer discussion we arrived at our second breakthrough: the only way out, for *all* of us, was to make SRSD successful.

There was no scenario where some of us would keep our jobs while others would not. We would all sink together, or we would all succeed together. I believe it was Scott who pointed out we needed to set aside our personal ambitions, and become ambitious only for the success of the organization. That might seem obvious for any leadership position, but every day the news is filled with stories of leaders who did dumb things to preserve their job, their status, or their bonus. We weren't going to be those people. We had just spent seven hours getting pummeled – by people we could not ignore – and we were ready to commit.

Things started to move pretty fast after that. Over the rest of that day and the next, we came up with plans to address the issues we'd heard about. Mike Beer's "tough love" coaching was instrumental in this. He'd clearly chosen the correct career path when he became an academic, but perhaps his best skill was his ability to facilitate honest discussions. You had to back up what you said, and if you said something just "to score points," he was in your face in an instant. Literally. He'd get a few inches away from your face and ask you to share the data you had that made you say that. Even slow learners like me only had to go through that cycle a couple of times before getting the message.

The plan we came up with was a matrix structure. One side of the matrix was the functions, such as Marketing, R&D, Manufacturing, etc. The functions were responsible for supplying the right number of people ("*who*"), and for ensuring those people had the right skill sets, especially in new areas such as software development, program management, and third party management ("*how*"). The other side of the matrix was the businesses; they would determine which projects to carry out ("*what*") and in what priorities ("*when*"). Neither side of the matrix was dominant; in fact, we drew the matrix as a diamond to emphasize this point. And we spent a lot of our discussion on what we called "decision rights," i.e. *who* got to make *what* decisions. We learned from Mike that most matrix organizations didn't bother with this step, which is why they often failed. We also spent a lot of discussion on the metrics. Our main concern was the primacy of SRSD's success. In other words, your business or function may be doing well, but if it came at the expense of the overall success of SRSD, you wouldn't be rewarded. This ensured we would always act as a leadership *team*, and allocate resources to the businesses for the best overall result.

The best part of the plan was that it eliminated, essentially with the stroke of a pen, the "cold war" between the custom engineers and the R&D engineers. Whether you were a custom engineer working on "rack and stack" systems to test RFICs with today's technology, or an R&D engineer working on the RFIC test platform for the future, it no longer mattered – you were now part of the same business, and the business would determine how to balance the two efforts. And you would undoubtedly have your chance to put your two cents in.

But a problem with our plan was that we could not afford to hire separate leaders for the businesses. So we decided that at least initially, three of us would have dual roles. John Vink would manage our signal monitoring business and continue as R&D manager. Jeff Gould would manage our MTA business and continue as our Manufacturing manager. I would manage the product lines related to component test (we called this business “RF Manufacturing Test”) and continue as the Marketing manager. Our fourth business, Aerospace & Defense systems, would be managed by Sam Scott. And because maintaining this legacy business was one of our two strategic tasks, it was Sam’s only role.

On both days our discussions continued deep into dinner, and the wine flowed liberally. Staring together into the abyss of complete failure had bonded us, and we somehow just felt like we were going to get this turned around.

On the last day of the offsite, the Employee Task Force returned, and we presented our plans to them. Perhaps emboldened by the fact that none of them had gotten fired after the first day, they felt free to barf all over several aspects of our plan. We were temporarily deflated, especially Scott, who felt we were being completely open with them, and struggled with why they didn’t seem to see that. But after a very open discussion, we ended up using almost all their suggestions in our modified plan, and secured the ETF’s support for it.

A week after we returned from the offsite, we rolled out our plan to the entire division, and it was received enthusiastically. Personally, I think we started the meeting with a lot of employee goodwill even before we showed the first slide, because by that time the employees could see that no one on the ETF had been fired for delivering bad news, and the promised anonymity of the interviewees had been kept. (In later years, I found it amusing that we got credit for not doing something that frankly, we had never dreamed of doing anyway. But, hey, whatever works!) The enthusiasm only increased when the employees saw us start to implement the plan over the next few weeks, and when we promised to repeat the SFP process each year (which we did). With the lines of communication now opened, and the new matrix structure starting to take shape, we began to turn things around pretty quickly.

FY 1995 was a banner year for SRSD. So in December we held a big holiday party for the SRSD employees and their significant others. It was such a blast that even though it was getting near midnight, almost no one had left. I saw Scott standing in the back of the room, and I walked up to him and we began chatting. Then, as if on cue, we both stopped talking and just looked around. Everyone was having such a wonderful time. And although we never discussed it afterward, I am pretty certain we were both thinking the same thing, and it was this: “we may come into the office on Monday morning and find that Dick Anderson has changed his mind about us and we’re all fired. But it won’t really matter, because we’ll still be able to say that at least once in our fricking careers, we did the right thing and it worked out the way it was supposed to.”

Of course, Dick didn’t fire us; he was in fact thrilled with the turnaround at SRSD. As we had promised, we implemented the Strategic Fitness Profiling process each year, with Jody as our facilitator, and each time with a new set of managers on the Employee Task Force and a new set of issues to deal with, although the issues in successive years were not as intense as the first year. We joked that we would continue the process each year until the biggest issue was the brand of creamer used on the coffee stands. Almost to a person, the ETF members later said it was the best learning experience of their career. Amongst the senior team, all of us had lengthy careers at HP and Agilent, and all of us felt the SRSD experience was the highlight of our careers. And as our success grew, SRSD became known as a learning organization – a place where you could learn something new and make a contribution – and *we* began attracting the talent.

After our second time through the SFP, Mike Beer got Scott's permission to write a case study about us. It was taught at HBS for a number of years, and maybe still is. I know the case is still available on the HBS website. We were also featured in one of Mike's books.

The RF Manufacturing Test Team

As noted earlier, after the first offsite in July 1994, I was asked to lead the business team we called RF Manufacturing Test. It consisted of the 8510 product line, the Antenna Test business, our SCMM systems, and the RFIC test effort. The product lines were linked because they all tested "things" (as opposed to signals), and often in a manufacturing setting rather than an R&D setting. The business was a good match for me because I had experience in all the product lines.

(I had been involved with the RFIC effort since we had selected it as a focus area in our market survey exercise the year before. I had written a memo describing why pursuit of this business would be a disaster for us. When we picked it anyway, Scott asked me to informally oversee the R&D effort. "Why would you ask me to do that," I asked, "when you know I think it's a bad idea?" "Because," Scott said, "you've clearly thought about the potholes we'll encounter, so you're the best person to ensure we avoid them!")

My lead managers from the "other side" of the SRSD matrix were John Barr as the R&D manager, Janice Pryst (known to everyone as "JP") as the Marketing manager, and Nancy Nardi-Gardner as the Manufacturing manager. My streak of good fortune continued; I simply could not have asked for a better team. We had a few issues as we all adjusted to each other and to the new matrix structure, but pretty soon we became an effective group of managers.

I soon found there was a pretty long list of business issues that hadn't been resolved due to the "cold war" before the reorganization. I told the team we were going to work through those quickly, and I also told them the same thing I've told every one of my teams since then: this is not a democracy. But I will always listen to what you have to say. And because you are good people, and because you know the business, you will find that about 19 times out of 20 we will end up doing what you want us to do. That other one time, you'll find yourself carrying out orders you didn't agree with, and you'll just have to suck it up. And so we got to work.

I was fortunate that my "other" job in the matrix structure, as division marketing manager, was made a lot easier by our new organization. I was no longer pulled in a bunch of different directions, because the major investment decisions were made in unison by the senior team, which of course included me. And we had experts from all of the businesses on my marketing staff, so estimating how many people we needed ("who") was pretty straightforward and accurate. We also had enough experience in the systems business to determine the appropriate marketing mix for our sorts of businesses ("how").

In my RF Manufacturing Test business leader role, we had lots of issues, but two really big ones dominated. The first was how to invest enough in RFIC test to keep up with the rapidly expanding market that 2G cellphones were creating. This meant that we had to be very careful about the investments we made in the other product lines. One thing we did to help this along was a twice-a-year meeting we called the "Blue Sky" meeting. Every RFMT manager and senior engineer was invited, and it was always off-site. Every person had the opportunity, if they wanted it, to pitch whatever idea they thought would help the business. We got a lot of great ideas from this process, and we always ended up with about twice as many ideas as we could fund. But because everyone had been heard – and we didn't just give them lip service, we had real debates – they could more easily go along with whatever we ultimately decided upon.

But as RFIC test grew, it inevitably began to get a bigger share of the investment pie. Of course, investment in the other product lines, especially the 8510, didn't go to zero, because as RFIC test grew, the overall investment we had to work with also got bigger.

Our second really big issue was how to be successful in a true manufacturing test business such as RFIC test. All of us had grown up in a world where most of our equipment ended up in R&D, and more specifically, Aerospace & Defense R&D. In this world, the best performance won, period. This was not so in manufacturing test. In that world, you needed *just enough* performance to test the customer's devices. Performance beyond that level got you nothing, and customers simply wouldn't pay for it. This was a surprisingly big adjustment we had to make to our collective mindset, and we all struggled with it for awhile.

Perhaps even more fundamentally, we couldn't even get *into* our targeted accounts at first. That's because they were managed by the sales force from the Automated Test Group, and initially they refused to set up meetings for us. They pointed out that: a) we were not part of ATG (which was correct, we were part of the microwave group); and b) we didn't know what we were doing, and so were very likely to generate ill will towards HP, which would harm the overall ATG business at the account (also correct, at least the part about us not knowing what we were doing!).

Fortunately, ATG was run by John Scruggs, and he understood he had a responsibility beyond just ATG, so we formed a "dotted-line" relationship with John and the ATG staff. This helped us have an air of legitimacy with the ATG field force. We were also fortunate that one of JP's strengths was building relationships, usually through a combination of reasoning and persistence. So we did eventually get in, and the field folks pretty quickly saw that while we had a lot to learn about manufacturing test, we understood the measurement challenges inside and out, and therefore could bring some value to the account.

Another big challenge was the nature of customer support in manufacturing test. In R&D, if your 8510 failed on a Friday, it was usually not the end of the world. You just called HP on Monday and they got going on the repair process. But in manufacturing test, even an hour of downtime could represent thousands of dollars of lost revenue for the customer. This meant we had to set up a 24 x 7 approach, with support engineers on call and with spares either on the customer's site or at least nearby. This hadn't been done before in the microwave group, and we spent many frustrating hours with Finance and other groups to make even the smallest bit of progress.

Another support challenge was the "user." In R&D applications this was usually an engineer. But in manufacturing test, there were multiple users. There were the actual operators of the system; usually these were people with no more than a high school education. There were the technicians, who did maintenance and basic troubleshooting. There were the production engineers, who wrote the test programs and sometimes designed the interface boards for the devices under test. And finally, there were our own Application Engineers, who had to know pretty much everything about our system in order to be able to support it at the customer's site. JP and her support team had to develop training aimed at all these user groups, and initially this put tremendous pressure on them, because historically microwave support groups were staffed at nowhere near the level needed to do something like this.

We also had to adjust to differences in the customer base and in just the very nature of the sales process. In network analyzers, we had thousands of customers, and maybe 1000 or so would buy from us in any given year. Our biggest customer in any year might be 2 – 3% of total sales. But the RFIC world had no more than perhaps 50 customers total, and maybe 10 who could drive any

significant volume. This was a blessing in that we got to know our customers *really* well, but a curse in that every sale was a high-stakes affair.

And selling was just very different from what we'd experienced in the microwave world. Microwave test equipment represents a major CapEx expenditure for any company, but this was a whole different level, as our "cheapest" system was nearly \$900k. And almost no one bought just one system. So we quickly got educated in "big ticket" selling, and most people assume this means it was a high-level sell. But that was not our experience; we discovered that it was an "all-level" sell. Sure, we'd often meet with the CFO and the CEO, but it was just as important to meet with the test engineers, the technicians, and the design engineers whose devices we'd be testing. They all had to be onboard before we had any shot at winning.

We also learned that before a CEO would plunk down several million dollars for test systems that stood in the company's revenue path (remember, we had to test the devices before they could ship them), he (I'm sorry to report that I only encountered one female decision-maker during my entire time in IC Test) wanted to look the head honcho in the eye. So as the head honcho, I was involved in every initial sale. The customers were also fiercely competitive, so my staff and I had to demonstrate we could keep confidences. We all got very good at keeping secrets, and I'm pleased to say we never violated a customer's trust in us.

The customers did not make their purchase decision on a combination of specs and price, like traditional microwave gear, but instead on a parameter called Cost of Test (COT). The entire semiconductor industry had standardized on a single COT model, and I actually attended a class to become certified on using the model, so I could be credible in front of customers. Basically, the COT model showed how much money it cost to test a single device on a given test system. Customers liked this approach because it prevented suppliers from "gaming" results to make them look better. The COT model had many levers, but the two biggest by far were initial purchase price and system throughput. So in order to win, we had to demonstrate the lowest COT. This assumed, of course, that all of the competitors could make all of the needed measurements, and this wasn't always the case when we first started, as RF measurements were initially a mystery to traditional IC test firms such as Teradyne, LTX, and others.

But the biggest adjustment we had to make in selling was the use of the product roadmap. This *really* grated on our microwave bosses, because "selling futures" had *always* been a big no-no. In the early 1980's, when I was working on the 8340A introduction, I had "pre-sold" the 8340A to some big military ATE programs, because they were literally generational – i.e. meant to last 20 years or so – and I knew the customers would be upset with us if I *didn't* tell them about the 8340A. But that didn't stop several people from calling for my head on a platter when I did it! But for the semiconductor firms, roadmaps made perfect sense. That's because their "switching costs" were so high. When they switched test platforms, they had to re-invest in training for all the users, interface boards, test programs, and spares. So they weren't going to make the switch very often (the rule of thumb was no more than once every five years), and that meant they had to know you could test not just today's devices, but the devices they were planning to introduce over the next several years. And you also had to demonstrate how you planned to reduce COT over that period. So current capability got you in the door, but you won or lost on your roadmap. All of this, of course, was utterly foreign to the way things had been done in microwave for decades.

Our other big challenge was Japan. All of our big customers were either in the U.S. or Japan. (This was before the rise of the big fab houses in Taiwan.) And the first few trips we made to Japan were exercises in bewilderment. Fortunately, we found a woman (I forget her name, which is too bad, because she was great) who offered a 1-day seminar on how to do business in Japan.

She had been the first American woman – ever – to be on the board of a Japanese company, and it turned out she really knew her stuff. We all had light bulbs going on throughout the seminar, and it made us realize how far off the mark we had been. JP, John Barr, and I met and decided we needed to use our new-found knowledge in a “charm offensive.” One of us would be in Japan every month, and if we didn’t have a reason, we would find one. This would let us share the travel burden, but maintain an essentially constant SRSD presence in Japan. We kept this up for about 18 months, and it worked spectacularly well. Now that we had the “secret decoder ring” of how business in Japan worked, we were able to get the information we needed from the field sales team. We understood what customers were really telling us when they uttered key phrases. And we adopted the Japanese cultural norms. For example, when something went wrong, the only acceptable way to apologize in Japan was face-to-face. So two of my trips were “apology tours,” where I visited each customer and apologized about incomplete or buggy software, and explained what we were going to do about it. But overall, the most important result of the charm offensive was the customers and sales people got to know us, and they began to trust us and to understand that we were not just there to make a quick buck, but in it for the long haul.

A Project Becomes a Division

As 1999 arrived, lots of things began to change. First, although we were all still HP for now, it was announced that the company would split into two. The computer, printer, and calculator businesses would keep the HP name, while all the company’s other businesses would be spun off into a new firm called Agilent. Ned Barnholt, who had been running Test & Measurement, would be our new Agilent CEO.

Second, T & M reorganized into a new structure called front-back. This meant SRSD no longer existed; in fact, divisions, as we had known them, no longer existed. To oversimplify, “front” organizations would determine what customers wanted, and “back” organizations would make those solutions. I had my doubts as to whether a business like RFIC Test, which required very high levels of coordination, could succeed in such a structure.

Third, rapid advances in silicon technology enabled much higher frequencies, which in turn meant that RF and baseband circuitry could start to share the same piece of silicon, thus reducing the number of IC’s needed to make a complete cell phone chipset. This was good news for the market, but not so good news for us. Our platform, the 84000, had been designed from the ground up to optimize RF testing. If we had to go back and add baseband test capabilities to it, the effort would be almost as large as starting over. We were going to need a Plan B.

I felt the best way to deal with these new issues was to spin off RFIC Test into a separate division that would become part of ATG. After all, one of our two strategic tasks in SRSD was to create new divisions, and RFIC Test already had bigger revenue than several divisions in Test & Measurement. Furthermore, we already shared the same customers, sales force, and Apps Engineering team with ATG, so moving the new division to that group just made sense. I put my thoughts into a memo to Byron Anderson (who now ran the Microwave Group, with the retirement of Dick Anderson) and to John Scruggs. I also copied Ned and Scott Wright, even though SRSD no longer officially existed.

I should have known that Byron and Scott would not be happy. The microwave group had diligently and patiently invested in RFIC test since its start as an 8-person R&D project in 1993. Now, just as those years of investment were about to pay off, I wanted to move it to ATG. So, after a few phone calls and e-mails, a meeting was set up in Santa Clara, where Ned himself would make the decision.

At the meeting, I marveled at Ned's ability to keep calm. In fact, over the years, I was in many meetings with Ned, and while he could get animated, I never saw him lose his cool. Scruggs did well at this, too. But the rest of us in the meeting were not nearly as successful. After about an hour of very vocal back and forth, Ned made his decision: we would become a separate division and move to ATG. I would be the general manager and report to John Scruggs. As I drove back from Santa Clara, I used my car phone to call JP, Nancy, and John Barr, to let them know the decision and that they'd all been promoted.

So, we had taken an R&D project with dubious prospects and turned it into a separate HP division, with the help of a lot of good people, a lot of hard work, and a *very* strong market. But it didn't feel as good as I thought it would, because I knew Scott was upset with the decision. But I had worked for him for over 20 years at that point, so I suspected our relationship would survive this pothole, even if it was a pretty big one. And it did.

A few months later, HP engaged in "title inflation," and announced that division general managers would now also have the title of vice president. Of course, it didn't change my job description or salary at all, but I think my parents got a kick out of my new business card.

We developed a good relationship with ATG management and with our counterparts. My fellow general managers in IC test were Minoru Ebihara, who ran the mixed-signal IC test division in Hachioji; Mike Bandy, who ran the flash memory test division in Santa Clara; and Reinhard Hamburger, who ran the digital IC test division in Boblingen. Mike was a great source of advice and coaching for me. Reinhard was probably the most like me in temperament, and we formed a good friendship. And Ebi (that's what *everyone* called him) had a near-mythical ability to tell you what decisions were going to come out of Corporate HQ before they happened. This was especially useful during the period when Agilent was separating from HP. The whole time I worked with him, I think he batted a thousand on his predictions; how he did this when he was an ocean and 16 time zones away is beyond me.

Our main focus was on platform strategy. The strategic problem was this: our biggest competitor, Teradyne, was nearly five times our size. They could afford to develop and field several test platforms. We could not, at least if we wanted to consistently make money for the corporation. At the same time, we felt there might be an opportunity buried in the problem, because more and more functionality was being placed on a single piece of silicon. So after tons of discussion, we arrived at a solution that seems obvious in retrospect, but which certainly wasn't at the time: we would all develop solutions for a single platform. We chose Boblingen's 92000-series digital tester, because it was the most-developed and the most flexible, although it was not the cheapest, which meant we would cede some battles at the low end of the market.

We called the new platform the 93000-series System-on-a-Chip (SoC) tester, and the idea was that by mixing and matching circuit cards that had digital, mixed-signal, and RF test capabilities, you'd be able to test pretty much any silicon device. After tons more discussion, we made a second decision that also seems obvious in retrospect: since customers made buying decisions based on COT, we would have to offer point-solutions that were competitively superior, and *then* pitch the 93000's flexibility as the icing on the cake for the customer's roadmap concerns. In other words, we could not *lead* with the 93000's flexibility, we had to lead with our ability to cost-competitively test a microprocessor, an RF downconverter, a baseband processor, etc.

Through this approach, we hoped to turn our limited offering vs. Teradyne into an advantage, rather than a disadvantage.

We were successful, and our new-found strength vs. Teradyne, plus the hot market fueled by the dot-com boom, meant that in Hachioji, in Boblingen, and in Santa Rosa and Santa Clara, we could not keep up with demand. Incredibly, cell phones were even hotter than the overall market. At one meeting, I rather boldly predicted that cell phones would eventually be a much bigger market than PC's. Everyone had a hearty laugh, and then Scruggs said, "You're aware that about 100 million PC's are made every year, right?"

"I am," I said. Of course, cell phones today are produced at over a *billion* a year, and have been for several years. But challenging the supremacy of the PC was heretical thinking in 1999.

Semicon West was the most important semiconductor trade show of the year, and Semicon West 2000, powered by the dot-com boom, was just way over the top. Rock bands played every night. The annual dinner was black-tie and \$1000 a plate, but still had so many attendees that it was held in a dirigible hangar at Moffett Field. The guest speaker was Colin Powell, who would become Secretary of State a few months later. Semicon West 2000 was a huge week-long party for a booming industry.

But as John Scruggs said the following year, "the bigger the party, the bigger the hangover." A couple months after Semicon West, I told John I was seeing some signs of a slowdown. He said no one else was, and maybe I was just losing deals and not realizing it. I told him I didn't think so, but we agreed I would check further, and get back to him in a few weeks. I did, and I told him I wasn't losing deals; customers were just starting to push them out. "I know," he said. "We've been hearing the same thing from Germany." It turned out that the IC test business was the canary in the coal mine. All of the instrument divisions were still going strong, and wouldn't start to feel the slowdown until a few months later, in early 2001. Right after the Semicon West show, John had asked Tom Newsom to lead the SoC effort, so Tom got all of us together to see what we could do to respond to the slowdown, but our options were limited.

As 2001 progressed, things got worse not just in IC test, but across Agilent (we were now fully separated from HP). In the late summer, Ned made the painful decision that for the first time in our 60-plus year history, we would have to do mass layoffs. There was a flurry of meetings on how we would implement the layoffs, with an emphasis on providing as much support as we could to the affected employees. We came up with a pretty good plan, and we decided that while individual site schedules might vary a bit, everyone affected had to be notified by Friday, September 14th. In our division, we had decided that my staff would notify the affected people on Wednesday 9/12 and Thursday 9/13. I would be back in the office from travel on Friday 9/14 and meet with any of them who wanted to talk to me. Then I was leaving two days later, on Sunday 9/16, to go to Hawaii with my wife to celebrate our 20th wedding anniversary. I felt bad about the timing, but we had made the trip arrangements many months before we knew any of this was going to happen.

September 11th, 2001

The "travel" I was on that week was one of Tom Newsom's staff meetings. Once a quarter, Tom would get us together for three or four days, to keep everything aligned on the very complex 93000 SoC platform effort. For the week of September 10th, the meeting was in Boblingen. On Tuesday afternoon, we were a few hours after lunch and the energy in the room was flagging a bit. Tom asked Dietmar Hoeller, the Boblingen manufacturing manager, to kindly pay attention and stop surfing the internet.

"Tom, I'm sorry, but I'm not really surfing the internet. It looks to me like America is being attacked," said Dietmar.

“What?” we all said, and then we rushed to Dietmar’s monitor, and saw the now-infamous video clips of planes crashing into the twin towers. We all looked at each other, trying to figure out what the hell was going on. A few minutes later, we got a call in the conference room from John Scruggs in Loveland. He told us what he knew, and said they were going to close the Loveland facility for the day. He also agreed with Reinhard that we should probably send everyone in Boblingen home for the rest of the day. I went back to the hotel and tried to reach my wife Denise, and of course I couldn’t, because all of the phone lines were overloaded. I finally got through, and then went deep into the evening trying to cancel the Hawaii trip, get a new flight back to the U.S., and getting updates from Denise. Everything went slowly because most of the time I couldn’t get an outside line, and because I also spent a lot of time glued to the TV. As the night wore on, it became clear I wouldn’t have to cancel the Hawaii trip; it was going to be cancelled for me because all flights were grounded. And for the same reason, it also became clear I wouldn’t be going back to the U.S. anytime soon.

Back in the U.S., Agilent Corporate faced a lose-lose decision: go ahead with the layoff notifications as planned, or keep everyone on pins and needles for at least another week. Eventually they decided to go ahead as planned. Since I wouldn’t be in Santa Rosa on Friday as I’d intended, I wrote an e-mail to the entire division apologizing for my absence, and asking them to treat the people who were going to be laid off with respect and compassion, because they were still our colleagues, and had lost their jobs through no fault of their own.

The following week I was able to get the last available seat on an Air France flight going from Paris to SFO. The passengers were not the usual business people you’d expect to see on a weekday flight, but instead were a mixture of all kinds of families, vacationers, and business people, all of whom had been stranded just like me. The flight attendants did a wonderful job of trying to make things feel normal, since a return to normalcy seemed to be what people wanted.

Usually when you touch down at SFO, the lead flight attendant gets on the intercom and says something like, “Ladies and gentlemen, let us be the first to welcome you to the beautiful city of San Francisco, where the local time is blah, blah, and the temperature is blah, blah, etc.” That didn’t happen on this flight. Instead, the pilot himself got on the intercom and said simply, “Ladies and gentlemen, welcome to the United States of America.”

Every passenger on the plane cheered. Adults and children, Americans and non-Americans, every one of them spontaneously cheered. And I felt like we would be alright. Not right away, certainly, but eventually, we would recover and be OK.

Unfortunately, as the months after the 9/11 attack wore on, the dot-com bust just got worse, and it became clear that as a company, we had not cut enough people. In the meantime, some parts of Agilent were trying other ways to deal with the issue. In the Components Group, they had talked about dismissing the people who landed in the bottom 5% of the annual ranking. John Scruggs also thought this was worth considering, and he convened the ATG general managers in Loveland to discuss it further.

As you might imagine, it was an emotional topic. On the one hand, here we were telling our people the importance of working cooperatively across divisions and sacrificing to ensure the overall success of the team and of the 93000 SoC platform. Now we were going to tell them that on the other hand, when it comes to annual ranking, you’re on your own, and the bottom 5% of you are gone? I didn’t think so, especially when we already had procedures in place – which we certainly used, at least in Santa Rosa – to deal with unacceptable performance. Several GM’s had this same point of view. But others felt just as strongly the idea had real merit. John said he

wanted an open discussion on the topic, and he certainly got it. We all ended up yelling at each other for the better part of two hours. I was certain I'd be fired, but I was so worked up I wasn't sure I cared anymore. Finally John said, "OK, I've heard enough. We are not going to adopt this idea."

And then the most amazing thing happened. Nothing. There was no retribution, no "career counseling" (which I *had* gotten from John a couple other times!), no suggestion that perhaps I and the other people who'd opposed the idea would be happier doing something else. I later asked John about it, and he just shrugged and said he'd wanted an open discussion, and we'd had one. If you really want to understand what made HP so successful for so long, spend some time talking to John Scruggs about how he managed his people. You'll begin to see what a unique company HP was.

Unfortunately, nothing we did or didn't do was going to save us from the dot-com bust. So we did another round of layoffs in the middle of 2002, and this time ATG had to do some actual restructuring in addition to laying people off. My team was going to be merged with the Hachioji team and another team in Loveland, which meant that my job as general manager was eliminated. Tom Newsom offered me a marketing job within ATG, but I decided it was time to move on. My nine years in the semiconductor test industry were over.

The Component Test Division

Fortunately, there was an opening for a Strategy Planning Manager right on the Santa Rosa site. It was in the Component Test Division (which is what the network analyzer team was now called), managed by Bob McClung. Bob's HR manager was my old friend Jody Edwards, and since she and I had been through the SRSD years together, she recommended me and I got the job.

The divisional planning manager job had been created as part of the front-back transformation that T&M did in 1999. It was a recognition that both R&D and Marketing sometimes did a less than stellar job looking at "what's next," gravitating instead towards the here and now. So the planning department was an attempt to force a fix to this problem by specifically naming a group whose job it was to focus on inbound tasks such as market trends and competitive trends.

It was a fun job and one for which I was well-suited, having just spent several years doing lots of "component test" in the RFIC world. Indeed, my first contribution was to point out to my colleagues that we were not living up to the name of the organization. We called ourselves the Component Test Division, but in fact all we did was measure S-parameters (which is what network analyzers did). My rallying cry became "beyond S-parameters," and as this broader vision of the business took hold, we began projects in such areas as multi-port measurements, signal integrity, and perhaps most importantly, non-linear component measurements such as gain compression and adjacent channel power. It was also in this role that I got the ball rolling on the inevitable: it was time to begin the process for discontinuing the beloved 8510, although we wouldn't actually pull the trigger for another 18 months.

But fun jobs never seem to last long, and such was the case this time. Things just continued to get worse in the overall market, and by early 2003, it was clear another round of layoffs would be needed. CTD was a prime target, because although it dominated its market space, it was still investing at a pretty high rate. So it looked like things could be cut back there with minimal damage to the business. And the cutbacks were severe: a gasp-inducing 50% headcount reduction in R&D. You can imagine what *that* did to morale.

The week after Bob announced these layoffs (and Bob, like me, was more of a growth-oriented guy, so having to do this, especially given its severity, just about killed him), he asked me to lead R&D. He felt that with my years of experience in network analyzers, and my very recent experience in planning, I might be able to provide some direction on what to do with our remaining resources, and in the process maybe convince people that things were not as bleak as they seemed.

I said I would give it a shot, but Bob said that before I signed up, there were two pre-conditions: 1) CTD had an R&D team in Kobe, Japan, and the relationship with Santa Rosa had never been good. Bob was worried it was a problem without a solution, but he wanted me to commit to trying to fix it. I had over 30 trips to Japan under my belt at that point, from my days in RFIC Test, so I figured I could solve this. 2) Before becoming a general manager, Bob had spent his entire career in R&D. He'd had success in developing printers, medical instruments, and Test & Measurement instruments. Along the way, he had actually developed and documented a philosophy of "how to do R&D," which he called Product Generation Excellence (PGE). He insisted I use this approach in leading the R&D team. I'd heard Bob's PGE talk a couple of times, and while I was a bit skeptical, I also figured, who was I to argue with success, so I agreed.

Historically, R&D managers wrestled with resources, specs, and schedule. The conventional wisdom was that if you pick any two, the third was fixed. And throughout HP's history, resources and specs were usually fixed, meaning "the schedule is what it is." The most novel aspect of the PGE philosophy is that it turns this thinking on its head, arguing that the ability of an R&D organization to generate new products *on schedule* is the single most important measure of its overall health. But this is not done arbitrarily; in fact, when done correctly, PGE is not an R&D capability, but rather an *organizational* capability. All functions must buy in and participate, or it won't work as intended. And without getting into it too deeply, there are several other aspects to PGE as well: how projects are selected, how schedules are maintained and reported, how specs are "flexed" when the inevitable schedule snags occur, and how to forward-leverage designs so the organization's competitive position strengthens with each new product introduction.

So I signed up for PGE, and as you can probably tell from the above paragraph, I went from being a skeptic to being a true disciple of the approach. But the first thing I did was to sit down, one-on-one, with each and every R&D engineer (50 in total) who remained after the layoffs. This was made easier by the fact that I had known almost all of them for many years. I just wanted to find out what they had been working on, and get their views on what we should do going forward. It was a great way for me to get up to speed, and to reduce the overall anxiety in the team, which, no surprise, was pretty high after a 50% headcount reduction.

The second thing I did was travel to Kobe, where I immediately uncovered the "relationship issue:" they felt no one in Santa Rosa had been listening. Once they believed I would listen, they spent about two days unloading on me with all the slings and arrows they felt they had suffered from Santa Rosa. Most importantly, they also had some solid ideas on how to improve things going forward.

So now I had good ideas from both Santa Rosa and Kobe, and I met with our R&D section managers and project managers. The section manager who had most of the engineers reporting to him was Mike Dethlefsen. He too was a PGE disciple, and he was also energetic, super-smart, and utterly committed to making his team the best R&D team in the company. Well before the layoffs occurred, Mike and his team had done some very thoughtful product roadmap work using PGE principles. So that meant we were not starting from zero; we just had to adjust to the new

resource realities. To oversimplify, we decided our future state would have two platforms. One would be the recently-announced Economy Network Analyzer (ENA). It would be the main platform for RF measurements and be developed mainly in Kobe. The other would be the Performance Network Analyzer (PNA), which was about two years old. It would be the main platform for microwave frequencies, and be developed in Santa Rosa.

In the roadmap, we showed how adding capabilities to these two platforms would: 1) blunt any competitive threats; 2) start to move CTD “beyond S-parameters;” and 3) reduce the number of network analyzer platforms from seven down to just these two. This last point was particularly important, because we could make a *major* reduction in inventory by having just two platforms. And inventory was a key element in Return on Invested Capital (ROIC), which was an important metric used by Agilent Finance to rate the financial performance of general managers.

So despite the huge layoffs, we had an R&D team with a demonstrated ability to deliver complex projects on time. And we had a product roadmap that would maintain our strong competitive position, start to get some growth by measuring more than just S-parameters, and significantly improve the division’s inventory position by going from seven platforms to two. And we had a good working relationship with our colleagues in Kobe, that I felt would only get stronger with time. You would think that would be enough, right? You would be wrong.

The layoffs had affected all microwave divisions, not just CTD. So afterwards there was some soul-searching in the microwave group about how to get more productivity out of the remaining R&D resources. The answer was pretty obvious: why, for example, did each instrument project design its own power supply? Why not have 3 or 4 pre-designed power supplies that project managers could choose from? And this same idea could be extended to front panels, displays, IF sections, and more. On the software side, reusable code could be developed for things such as display drivers, data processing routines, etc. So a team was created, called the Common Components and Architecture (CCA) team, to determine what common items would be needed by the microwave group, and to actually start creating some of those items, both in hardware and software.

This was a difficult job, because getting engineers to agree on anything, especially future things that have not yet been created, is akin to the proverbial herding of cats. And there were a *lot* of engineers with a *lot* of opinions in the R&D teams across the microwave group. So this began to wear on the CCA team, and it manifested itself in what I called “the loyalty test.” In other words, the CCA team wanted each R&D manager to pledge that (with apologies to *Field of Dreams*) if they built it, we would come.

I could make no such assurances. We had two new platforms, the ENA and PNA, and we were now in the process of enhancing their capabilities to keep the competition at bay, and to be able to discontinue the older platforms. But I thought the CCA idea was great, and if I *were* designing a new platform, I would absolutely use it. I made all of this clear at the biweekly meetings we had with all the microwave R&D managers. But it was not enough.

“If you opt out, other divisions will think they can opt out too.”

“I am not opting out. I just don’t have a need for it right now, because we aren’t doing any new platforms. We are enhancing recently introduced platforms.”

“But it will look like you’re opting out.”

“Well, all of the relevant players are here right now, so let’s just make it clear what CTD’s position is now.”

“But there are general managers and marketing managers who aren’t here right now.”

“I’ll be happy to speak with any of them.”

“The point is you designed your platforms without using CCA and other divisions will think they can do the same.”

“CCA was not available when CTD re-designed their platforms, so we obviously couldn’t use it. Furthermore, if I am one of the other divisions, and I am re-designing a platform *now*, why would I turn down something that helps me design a product for less money and in less time?”

Around and around we went, getting nowhere. I began to understand this was no longer a rational discussion; I was dealing with zealots. You can always tell; it’s whenever you hear arguments suggesting that anyone who is not with them is against them. But the world is almost never that black and white.

The other argument the CCA team brought up was metrics. They had prepared an elaborate spreadsheet showing the ROI of the CCA effort as different platforms adopted it. Because CTD was so large, its usage or non-usage of CCA would definitely move the needle on these metrics. I suggested that CCA was obviously a valuable asset for the microwave group over the long term, and any metrics that indicated otherwise were flawed. It was no soap.

Finally, I asked the million-dollar question: “what would make you feel good about CTD’s support of this program?” The answer: completely re-do our two new platforms using CCA. A back-of-the-envelope calculation suggested that would cost between \$5M to \$10M, take at least two years, and not enhance our competitive position one iota. And I wasn’t going to get extra money or people to do this, so I flatly refused. Thus, the message that filtered up to Pat Byrne, the head of the microwave group at the time, was that CTD was not being a team player, and its selfish behavior was going to kill off CCA.

Pat was a pretty savvy guy, so he of course knew there was more to the story than that. He convened a meeting of all microwave GM’s and R&D managers, and he said the purpose of the meeting was for each R&D manager to describe how he was going to implement CCA. The meeting was set for my wife’s birthday, and as I walked out the door that day, I told Denise I might have a birthday surprise for her: I was going to get fired! Agilent had become a much more political organization than HP T&M ever was, and by this point I had developed enough political instincts to recognize an ambush when I saw it.

As I walked towards the meeting room, I saw Pat and Bob McClung meeting one-on-one in a small conference room. I didn’t think much of it.

When my turn came, I described what CTD was going to do. I think I was on the third slide when the ambush arrived. Someone asked, “This is only supposed to be about *how* you are implementing CCA. So, yes or no, are you implementing it?”

“We are not, for the reasons I’ve started to explain in these slides.”

“But if you were ordered to, and you didn’t, why shouldn’t you be fired right now?” And then several other people started in on that same vein. I was accused of being arrogant, of

insubordination, of putting the good of CTD above the good of the overall microwave group, and probably a few other things I can't remember.

I just stood there and let everyone vent, but I didn't say anything. In my years in sales and marketing, I had been taught that when someone was angry, you just let them pour it all out, because they aren't going to listen to anything you have to say anyway, until they've gotten it all out of their system. After a few minutes of this, Bob McClung jumped in, and said my R&D plan had his full support, that it was the right set of things for CTD to be doing at this time. Everyone then turned to Pat, but he said nothing, and the resistance collapsed right there. Then I understood why Bob and Pat had been talking just before the meeting!

A few weeks later, a general manager job came open. I applied for it and (with timely coaching from Jody) I got it. In the span of six weeks, I went from senior managers in the company screaming for my head on a platter, to becoming a general manager again.

DATS

The division I was now in charge of was called Defense, Aerospace, and Transportation Systems (DATS). As the name implied, we built systems mainly for Aerospace / Defense and for Automotive test. We had a lot of people in Santa Rosa and in Loveland, but we also had teams in Lake Stevens, Japan, and Columbia, MD. We were part of the microwave group, so Pat Byrne was my new boss.

The major strategic issue in DATS was that it had been losing money. I needed to develop a turnaround plan to fix that. Fortunately, there were lots of levers.

The Aerospace / Defense business was in Santa Rosa and run by Jim McCord, so it was pretty easy to sit down with him and determine which product lines to keep, and which ones to exit. But exiting had to be done gracefully, because an abrupt exit would upset customers who were also important to the product lines we were keeping. So we had to accommodate their timelines, which in many cases were frustratingly slow.

Also, the big trend in A/D systems was synthetic instruments, which was sort of like what we were doing in CCA, only the idea was to make it accessible to customers, not just internal Agilent designers. The DoD figured, correctly, that if they could use building blocks to configure and re-configure instruments "on the fly" via software control, it would greatly reduce their logistics costs, and therefore the overall cost of owning the system for the next 20 years or so. For a variety of reasons, it was just not going to be possible to make CCA usable by customers, so we had to come up with something else. The obvious choice was to take existing instruments and put them into a modular format such as PXI or VXI. But this was very expensive, because every board in the instrument had to be re-layed out in the PXI / VXI format, then tested, manufactured, supported, etc. The ROI just wasn't there for such a huge effort.

We had Frank Angelo, also in Santa Rosa, spend some time looking at the problem and talking to the target customers. He came up with a startling insight: just take the existing instrument boards as they were, but re-arrange them to take up minimal space on the front of the rack. No re-layout would be needed, and the engineering would be focused on power supplies and proper cooling for the boards in the rack. This made the ROI look much more attractive. We also needed a way to be able to communicate with the boards, and Frank decided upon a LAN interface. This was the start of the LAN Extension for Instruments, known as LXI. In one stroke of brilliance, Frank had taken us from being nowhere in synthetic instruments, to being the front-runner.

Another big trend in A/D was simulating the threat environment, to see how radars and electronic warfare equipment would perform under realistic conditions. We decided we could pursue the high end of this market with an arbitrary waveform generator (AWG), that used some technology from Agilent Labs that had never been commercialized. Andrew Caminschi led this effort, and he and his team did a superb job of demonstrating how rapid development and prototyping could work.

In Lake Stevens, Niels Fache had a team doing some interesting early work on geolocation, and we decided to continue with that. Lake Stevens was also the home of our surveillance business. The revenue was good, but the profit margins were not – it just took too many specialized people to execute the business. Plus it was hard to understand what was going on in any detail, because I was in the middle of the lengthy process needed to get the proper security clearance. In the meantime, I tried to raise prices, but got a ton of pushback, from customers and from people on the surveillance team. I actually had people calling me unpatriotic because I didn't want to run the business at a loss! In retrospect, I should have been tougher on making the business perform or else. It was just difficult to do when I wasn't there full time, and I didn't have all the facts due to my lack of a clearance.

Finally, in Loveland, the Automotive Test business was transitioning to two new platforms, both of which were promising. I had verified this with some visits to big parts suppliers in Japan.

All in all, we felt like we had a decent plan to turn things around. The one bugaboo was time. Because sales cycles in A/D were so long, we projected it would take us about 18 months to get out of the red, and another 18 months before things really looked good. So after discussing it with Pat, he said he would get some feedback from Bill Sullivan (Ned had retired by this time, and Bill Sullivan was the new CEO of Agilent). The feedback we got from Corporate was that while they thought the plan would work, they didn't think the company could afford to wait as long as we projected we'd need. Accordingly, we were directed to shutter the division. The AWG and LXI programs would continue, but would be transferred to other divisions. The surveillance product line would also be cut back, but would continue as a smaller team. We were told to lay off everyone else.

So for the second time in just over three years, I had to preside over the dismantling of a division I was running. Laying people off, I found, did not get easier with practice. Pat had mentioned a few other possible positions for me, but after thinking about it for awhile, I decided it was time to go. In the last four years, it seemed like I had done little other than cut expenses, lay off hundreds of people, and engage in pointless political battles. Plus, management's focus seemed to be on where we could save another nickel, rather than on where we could make a contribution. I felt out of place in the organization. I informed Pat and HR of my intention to



Of course, at the end of our technical careers, we realize that, our great families, who tolerated so much of our loyalty to HP/Agilent during all those years, have grown up around us. This photo is from 2017, on the day our daughter Laura graduated from Sonoma State University. From left to right: our grandson Nathaniel Fossi, our daughter-in-law Kristin, our son Anthony, me, Laura, Denise, and Mike.

resign, and in July 2005, 27 years to the month after I started, I walked out. I would have many adventures in my post-HP life, but that is for a different story.

After I left, I felt bad about the way things had ended. But that only lasted a few weeks, as I began to realize that while the last four years may have been rough, I had little to complain about in the first 23 years of my career. I had been associated with some of the most iconic products of the microwave industry. I had gotten to see much of the world, and I learned how everyone is different and everyone is the same. I wasn't rich, but at the same time I wasn't exactly worried about where my next meal was coming from. And I had learned a ton – about technology, marketing, the R&D process, people management, business management, negotiations, high-level selling, and so much more.

But most of all, I had the privilege of working every day with a talented, motivated, and principled group of people – the people who managed me, who were my colleagues, and who worked for me when I became a manager.

Truly, I was a most fortunate individual.

Appendix 1 – The Stuff I Left Out

When I lived in Amsterdam, I traveled somewhere in Europe almost every week. From 1992 to 2005, I made over 30 trips to Japan. And almost every job I held involved a fair amount of travel. So you can bet I have a few travel-related stories. I've been assaulted, been in real and fake bomb threats, encountered dead people, had close calls with various wild animals, and taken at least a dozen taxi rides I was sure I wouldn't survive. None of that's in here, because it would have (at a minimum) doubled the page count, and the damn thing's already too long. It will have to be a separate story.

I also largely left out commentary on “how we worked.” The culture in the 70's and 80's, at HP and at most American businesses, was much more freewheeling than now. We routinely did stuff that would be considered highly inappropriate (or worse!) nowadays. When people left for new assignments, we would “roast” them with material that was often R-rated. When new sales engineers came into town for training, it was a point of pride amongst us that we had been thrown out of most of the better restaurants in Santa Rosa. We pulled pranks so elaborate they sometimes ended up in the local newspaper. But it was all done in a spirit of fun, because we all genuinely liked each other, and regarded each other as family. It all came down to the *people*, which leads me to Appendix 2.

Appendix 2 – Why Was HP So Successful? One Person's Opinion

In the preceding pages, I've described how fortunate I was to be associated with some great products and a string of great bosses. But my good fortune extended way beyond that. I learned something from nearly all my colleagues, both in the field and in the factory. And I could write pretty much forever about all the great people who worked for me, and who gave everything they had to make the team successful. I especially have to mention all the administrative assistants I had through the years, who were uniformly outstanding. Cindy Jacque was my assistant for 10 of my 27 years with the company, and I simply could not have asked for a better person to work with every day.

Indeed, when I left Agilent, I wrote a memo to my team and to others I had worked with to let them know of my resignation. I pointed out that in my 27 years, I had probably worked with well

over 1000 people throughout the company, and could count on one hand the number of people who didn't belong, and still have fingers left over.

So I really believe the key to HP's success through the decades was superb people, top to bottom. Which begs the question, how did we end up with them? I believe there were two reasons.

The first reason, I think, was the HP Way. When I first left Agilent, I was surprised at how many people I encountered who thought the HP Way was so much hogwash. Some were motivated by jealousy, some by lack of understanding, and there were some who thought it was just the written code of a cult. I disagreed then, and I still do. The HP Way survived pretty much intact from the late 30's until at least the early 2000's. Think of the immense change that occurred in the world during that time, and yet the principles behind the HP Way still seemed to resonate. Furthermore, the HP Way was successfully applied across nearly every culture on the planet, and in businesses as varied as RF transistors to enterprise-wide computer systems. To me, that is very strong evidence that the HP Way was a set of principles that just made sense to most people, and it motivated them to apply for a job at HP, and once they got there, to thrive.

So if the HP Way motivated lots of people, including many of the best, to apply for a job, how did we pick the "best of the best?" That leads me to my second reason for HP's success through the years. I believe the company was "unconsciously competent" in hiring. If you're not familiar with that phrase, the best way to explain it is to use a golf analogy:

- **Phase 1** – you watch a golf match on TV. You see guys screw up shots. You think, "how hard can it be to hit a ball that isn't even moving?" You are "unconsciously incompetent." It's also sometimes referred to as "you don't know what you don't know."
- **Phase 2** – you borrow some clubs from your buddy, and go to a nearby driving range. You hit many balls, most of which go about 10 feet, and very few of which go straight. You utter phrases like, "It's harder than it looks." You are now "consciously incompetent."
- **Phase 3** – you diligently practice for months and months, and find that on a good day, if you really focus, you can hit *most* shots decently. You have now graduated to "conscious competence."
- **Phase 4** – after decades, you no longer think about the swing itself. You are thinking about the wind, the terrain, and whether there is any advantage to trying to play a small fade or draw. You are now "unconsciously competent."

I think Phase 4 is where HP was in its hiring practices, and it was developed over decades. We simply could not help but make good hires. Even our iconoclasts – and there were many – can be explained as the organization unconsciously understanding that it needed some people who could stir the pot and challenge the status quo.

Of course, the idea that it was great people who drove HP's success through the decades is hardly an original one. In fact, Jim Collins and his team *proved* the importance of good people in their book, "*Good to Great*," with their "get the right people on the bus" concept. But for those of us who were fortunate enough to work at HP in the second half of the twentieth century, we didn't have to wait for Jim Collins to tell us that.

We lived it.

Appendix 3 – Reading List

There is of course a large industry built around books providing business advice, and while I was not a huge reader, I did go through quite a number of them in my time. Below are six books I found to be very helpful, and two Honorable Mentions.

- ***In Search of Excellence***, by Peters and Waterman. The 1980's classic seems to have been forgotten in recent years, as I think Peters sort of fell out of favor with the intelligentsia. But its concepts are timeless. “Whenever anything is being accomplished, it is being done by a monomaniac with a mission.”
- ***The Art of War***, by General Sun Tzu. “The most skillful generals win without fighting at all.” This alone, if tattooed on the forehead of every American business leader, would make a huge improvement in how American businesses perform. Another maxim: “if you understand yourself and your opponent, you need not fear the outcome of a thousand battles.”
- ***The Effective Executive***, by Peter Drucker. It's short and it's fun to read just for the 1960's-style language alone. But if you can get past that, there is good stuff on almost every page. I've read it at least three times.
- ***Marketing Warfare***, by Al Reis and Jack Trout. It was easy to dismiss when it first came out in the 1980's, because it was written by two ad guys, and it was surprising how many times the answer to your problems was – almost magically! – advertising! But it has since become something of a classic, because the core concepts were, and are, sound. We used them successfully in our Antenna Test program and in the introduction of the 8720A network analyzer. I also used them in jobs I held after I left Agilent.
- ***Good to Great***, by Jim Collins. A rigorous study that proves what separates good companies from great companies. Another book I've profitably read several times.
- ***High Commitment, High Performance***, by Michael Beer. OK, if you've read this far, you know that Mike was the guy who helped us solve our issues in SRSD, and yes, we are in this book. But the book does make a persuasive case for the idea that the **only** sustainable competitive advantage is a resilient organization, one that can learn and adapt.

Honorable Mentions:

- ***Bottom-Up Marketing***, by Al Reis and Jack Trout. The central idea is the best marketing doesn't come from the ivory tower, it comes from a deep understanding of what really works “in the trenches.” It correlates well with what I experienced in my career.
- ***Open Innovation***, by Henry Chesbrough. Makes a great case for a collaborative, “open” R&D program to create business success. The whole time I was at HP and Agilent, “Not Invented Here” was a pretty powerful force. What surprised me was when I left Agilent and went to **much** smaller organizations, NIH was nearly as powerful, even though it clearly made no sense! Throughout my career, I had only limited success promoting the concepts from this book, but that doesn't mean they were wrong!

Appendix 4. Post-Script: The Tubbs Fire of October, 2017

On the evening of Sunday, Oct. 8th, 2017, I was working late in my home office. It was a warm Indian Summer evening, so I had the windows open, and the wind was roaring through the house sounding like a locomotive. I commented to Denise that I'd never heard the wind this loud before, and then I finally went to bed around midnight.

We were awakened around 1:30 am by an automated call from the Sheriff's department, ordering us to evacuate. We could smell the smoke in the air. Denise asked me to go outside to check if I could see anything. When there's no fog, I can see Building #3 of the Keysight facility from the middle of our street, so I looked in that direction. Everything was a giant orange glow. We threw some things into Denise's car and then headed to the Finley Center, as the call had instructed. But we ran into traffic gridlock and couldn't get there. Next we tried to go to Healdsburg, where Denise's sister lives, but Highway 101 had already been blocked off by the police. Fortunately, I knew a bunch of side roads on the west side of the freeway, and we slowly wound our way north. When we looked to the east, we could see 30-foot flames on the other side of the freeway. As far as we could tell, all of northeast Santa Rosa was on fire, including our house and the Keysight facility.

We spent Monday in Healdsburg, but could get very little news about what was going on. Finally, our closest neighbors, from up the hillside that forms our backyard, called us. They had decided to stay and fight to save their house, and they had been battling embers with buckets of pool water (there was no water pressure). They were losing the battle as the fire melted some jet skis in their driveway, when a lost out-of-town fire truck wandered by and helped them out. They saved their house and as a result, ours too.

Later that day, we started to hear about looting. So we decided to drive back to our house. It was a strange journey; as we got close to Santa Rosa, the guardrail posts on the highway were still burning, and we ran into a giant gray cloud. From the highway we could see some areas that were destroyed. Several freeway exits were closed, so we had to take a very roundabout path to get to our house. When we got there, our son Mike, who lives in San Francisco, was already there, trying to wet down the house with the tiny amount of water pressure coming out of the pipes. He had driven up to Santa Rosa after he also heard the reports of the looting.

There was no electricity and no gas, but we decided to stay there for the night, sleeping with our masks on. The next morning, Tuesday, Mike and I headed into the neighborhood, to see what had been damaged. It took us about a 3-minute walk to reach the burned area, and I will never forget what we saw. The entire neighborhood was simply leveled. The only three-dimensional aspects to the landscape were the occasional stone chimney, and the reddish-brown hulks of burned-out cars. Other than that, everything was just a flattened pile of ashes. There were still a few very small fires here and there, from tiny piles of wood. We looked at each other, wondering what the hell could have caused such utter destruction.

The police came by later in the day and ordered us to evacuate again, and they said this time we would not be coming back for awhile, until the danger had passed and fire had gotten under control. And now they had enough help from out-of-town police and the National Guard to enforce it, and to prevent looting. We went to stay with Lorenzo and his wife Kerri; although they live close by and also had no gas, they at least had electricity. Lorenzo and I began comparing notes. Over 5000 buildings in Santa Rosa had been destroyed; about 3500 of them were homes. The four main buildings of the Keysight facility had all sustained some damage but had miraculously survived; however, the two modular buildings on the campus had been leveled. One of the buildings had housed Bill and Dave's archives. We also learned that over 80 Keysight

employees had lost their homes; when we added in all the HP/Agilent retirees we knew, the total was much higher.

My entire family volunteered in various ways to help out and to raise money for those who'd lost everything. Almost everyone in the city did this, even some of those who had lost their homes. Denise worked almost every day at one shelter until it finally closed just before Christmas. The entire city has rallied around rebuilding, even though we now know it is going to take a very long time.

When we first showed up at Lorenzo's house, he and Kerri told us their one house rule: "stay as long as you need to." I pointed out that the fire was not yet contained, and our house was still in some danger, so it might be weeks or even months. Lorenzo's reply: "Stay as long as you need to." That's how it is in Santa Rosa these days. People just keep putting one foot in front of the other, rebuilding a little bit each day. As long as we need to.



The disastrous fire of October, 2017 destroyed a modular building which housed the Santa Rosa Credit Union and worse, the corporate archives which included Bill and Dave documents.



The Round Barn was a landmark structure at the 101 Freeway entrance to Fountaingrove Parkway which led to the HP Campus.



The Round Barn on fire. The firestorm encroached on all sides of the Keysite Campus but amazingly it was mostly undamaged.