My Life of Hewlett-Packard and Civic Volunteerism

Bob Grimm

Editor Note:

Life Sets our Schedules

We've been working with Bob for several years now, to capture his fascinating life and times, from his Purdue engineering student days, through retirement. We used content from his oral history, converting it into a first-person narrative, and other material that he supplied from his pictures and files. We came to a pretty complete "final" draft, which still needed a little of his attention, and a few peripheral questions answered. That was more than a year ago.

But any of you who knew Bob, knew that his days were full of volunteer work, so he continued to defer his attention in order to do what he loved. He was volunteering for some new election issue, working on his beloved Tech Museum tasks, and just now, a safari trip to Africa. That is where Life took over his schedule, and left all of us stunned by his sudden demise.

With the permission of Bob's children, we have finished the contents of Bob's interesting and challenging life story, leaving a few minor holes, and published it herewith. But it still reveals a truly amazing man in his quest for technical excellence and a humanity in spirit. His HP story shows again just what a rewarding work culture we had at HP, propelling all that growth in the second half of the 20th Century. Along with his wife Marion, they fulfilled the Los Altos community vision.

Foreword

Mr. HP Management Pioneer -- Mr. Civic Volunteer Hero -- Bob Grimm

The life story of Bob Grimm is not well known, even among those of us who were at HP during the same decades. We, of course, knew that Bob's name was connected with the new "System Division," in 1956, which was called Dymec. But his HP career really started 5 years before that, in the early-1950s, when he was one of only 20 engineers, working in the original Redwood building. I did not know that he was getting ready for his long HP career by designing the modulator for the 618B signal generator. Or that he was in the middle of design of those somewhat obscure TV and FM 335-series broadcast monitors--I somehow thought those were Al Bagley's domain. Nor did I realize that Bob was one of the designers on the legendary HP 150A, the first 10 MHz oscilloscope introduced by HP. The introduction story of the 150A, at the 1956 IRE Show in New York City, in the middle of their worst snow storm in 20 years, alone, is a fun reason to read on.

Every one of our previous HP memoirs has some kind of charming story in the life of the author. In Bob's case, I was fascinated by his life at Purdue University. First of all, his faculty advisor was Professor John Cage. John Cage had previously worked for General Electric, and back in about 1938, turned out to be the boss of a brand new Stanford Electrical Engineer, David Packard. Cage then moved to a Purdue professorship, a few years before Packard hired him into the HP Labs, to manage the low frequency section. But, in a prediction of his later career, Bob ended up at Purdue in a "custom electronics shop," which was charged to design and build ANY electronics assembly that was needed by the school. A sort of industrial custom model shop. Little did he know that, in his later Dymec days, he would be meeting similar customer needs for custom measurement systems, probably the true joy of his life.

Bob relates how Bill and Dave decided that there was a profitable demand in customer needs for assembled measurement systems. Many aerospace and other industrial companies bought HP instruments and had system engineers who integrated them into complete programmable systems. But that wasn't easy because so many of HP instruments of the time WERE NOT programmable. Stimulus instruments like signal generators used hand cranks to tune frequency. Measurement instruments had NO DATA OUTPUTS. So Dymec developed engineering expertise to modify standard HP instruments. Believe it or not, they invented motor driven servo systems to rotate those hand cranks. They even built "knob twisters" which could rotate selector knobs on a standard front panel. That was the state of measurement automation before the advent of the HP-Interface bus. It was rudimentary, but it worked, and customers were delighted with having HP do that system integration, rather than themselves.

But looking back, there is no doubt in my mind, that one of Bob's early Dymec projects had an massive effect on the Hewlett-Packard of the 1980s onward. And that was HP's first mini-computer, the HP 2116A. Created by the creative team under Kay Magelby, it was introduced in 1966. It became the ancestor of HP's enormous successes in the computer industry through 2014. The HP 9100A desktop calculator, introduced several years later, and intended for individual engineers, then proved that HP creativity could be applied to computation at the workbench.

After some years, Bob left Dymec, as they divided their product line into data acquisition and automatic measurement systems. He was one of the principle managers in the new Automatic Measurement Division, first downstairs in Bldg 11, and then Sunnyvale. And incidentally, Bob was my boss when I moved to AMD in 1972. So I was able to watch his excellent management skills in a business market that was clearly different than selling instruments one by one. This was high-level selling, because the sign-off for some of those systems were $100--200K+, meaning often it was a vice-president approval.

After a few more years of system management, Bob transferred to a corporate marketing job, reporting to Noel Eldred. No one would ever turn down an assignment with Eldred as your boss, because he was THE preeminent marketing executive of that high tech age. This led to more opportunity in HP Labs, except that in this case, his boss was the formidable IQ=180, Barney Oliver. Wouldn't THAT be intimidating? It would be for me, and I had some experience, since Barney was my interviewer, when I walked in the front door of HP at 395 Page Mill, and applied for work in 1957.

Out of that initial work for Barney, came the job as "provisional" manager of a huge project to design and install an integrated circuit engineering and manufacturing facility within HP Labs. Bill and Dave and Barney merely proclaimed that it was to be the best state-of-the-art process center that we could build. Bob gathered a team of expert engineers and scientists and started to build in Santa Clara. But along came a vacant Fairchild building over on Deer Creek in the hills behind HP. With that purchase, Bob and his team did indeed create the capabilities that befitted the other creative talents of HP's Central Research Lab. Bob ended up as Director of the IC lab for about 8 years, during which time they supported some of the most advanced instrumentation and computer technology that was happening on this earth.

After Barney's retirement, and John Doyle's reign as HP Labs V.P., Bob took over as Director of the HP Technology Center, one portion of the Labs. After a few years, he became Director, HP Manufacturing Technology Center, a forward-looking group of scientists and engineers, who took as their vision, to change the way HP manufactured their products. Their eyes were on future manufacturing processes. How to DESIGN for manufacturability. How to automate assemblies, how to use robotic technologies, how to produce state-of-the-art printed circuit boards with automated surface mount elements. The production efficiency leverage of these concepts would sweep over the company for years.

Bob looks back on a remarkable career of innovation, creativity, management success, and leadership in cheerleading the best of his people. But all during those HP decades, Bob was spending some good percentage of his time outside HP, in a continuing commitment to industrial volunteering. Almost from his first years at HP, he followed the good lead of Bill and Dave, in offering his talents to community service. The list of different organizations range from the United Way, to Mayor of Los Altos, to becoming one of the Founders of the science museum called the San Jose Tech Museum (The Tech). The actual list of civic organizations goes past 12. Imagine that, considering that he was holding down some tough leadership jobs at HP, with major demands on his time and energy.

But he did both, for most of his years. There is no doubt in my mind that he is the HP record-holder for his years of community volunteerism. All along that way, he was accompanied by his wife, Marion, who was matching him on continuing civic service. His memoir, herewith, shows that he had a lot of fun doing them.

--John Minck

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Part 1--My Early Years

Boyhood, Macon, Missouri

I was born December 16, 1926, in Macon, Missouri. Macon is in the north east corner of Missouri, sixty miles west of Hannibal, the home of Mark Twain. Macon had a population of 4,000 people that year, almost 90 years ago, and it still does.

My dad was a Lutheran minister in Macon. We lived in the parsonage, right next to the church, so I grew up as a preacher's kid in a small town, with the eyes of that world on me. That was a very interesting life because I didn't know anything different.

I had one brother and one sister. Both of them were younger. My brother was a judge in Missouri on the Court of Appeals, and died in 2012. My sister's name was Donna. She lived in Portland, Oregon. She was a CPA. She and her husband, Stan Gieger, had a company that did biological research in the environmental field. They measured water pollution and designed remediation for it. She died in 2006.

Even coming from a bible-based household, I guess I was always interested in electrical things when I was growing up. I liked to do things, to a large extent by myself, and luckily, my dad was supportive of my projects. We had what was once a small chicken house next to our detached garage. It was about 10 x 10 feet. We got rid of the chickens at some point, and my dad let me have it for a shop. I spent a lot of my time out there. I was always interested in electrical stuff. I built my own darkroom, built my own enlarger. It was a projector I converted to an enlarger. I built a table saw. I had a good time working by myself.

It was a happy time. And depression time, but I don't think we ever thought about it. Money was tight, but we had big gardens. During World War II, we had a victory garden like a lot of people did, in addition to our regular garden. My mother baked every week, and she baked almost all of the breads and pastries and coffee cakes and other things that we had. She canned during the summer. She canned tomatoes and corn and green beans and pickles and everything, and that was used up in the winter. We had a lot of fresh fruit and vegetables during the summer. A lot of the congregation were farmers, and they would bring in food and other commodities. We weren't suffering, I mean, we didn't have much money, but neither did other people.

I was always wiring things and doing fun projects. I had a paper route when I was probably in about eighth grade. A guy named Jimmy Blankenship, about a year older than I, lived at one of the places on my route where I'd periodically stop to fold my papers. He was very smart and he was into radios. He was actually building radios and we got to talking. I decided that I wanted to build radios too, so he showed me how. We built superheterodynes. Then I collected old radios. I didn't have enough money to buy parts, but I got all the parts I needed by taking old radios apart. There were a lot of old radios around.

The first real job I had, after my paper routes, was working in the Kroger grocery store at thirty cents an hour, the going rate at that time. I would work after school and on Saturdays. During the summer, I would work full time, and full time then was sixty hours a week. I got paid $18 a week, less social security, which was about twenty five cents. Those were long days compared to what people think of now. The store opened at eight and closed at six and that's what you got paid for; but you had to have the store ready & stocked, before it opened, and you had to clean it up after it closed.

Macon was a farming community, so Saturday was the busiest commercial day in town, because that was when all the farmers would come into town. Then we'd open at eight in the morning and stay open until ten at night. These were the days when things like flour and salt and beans were bought in large 40 to 50# sacks. I can still remember these big burly farmers, they were strong enough to lift an ox, coming in. Of course, they'd park two blocks from the store and I had to carry all their supplies from the store to their cars.

There was a man who ran a florist shop, who had been a radio hobbyist. The nice thing about him was that he had saved old radio magazines. All the new magazines had circuits using tube types that I didn't have, because all my parts came out of old radios. So he gave me these ten-year-old magazines, and that allowed me to built stuff from those circuits. Then Jimmy and I started building transmitters so we could communicate back and forth.

Of course, we were transmitting without a license. We had a good time and my folks encouraged me. The only guy who really understood electricity in the whole town was the radio repairman. I was always pestering him, and asking him how to fix things when I got stuck. One Christmas my folks asked him what to get me for my gifts. He recommended a radio physics reference book which was about three inches thick. I read that thing from cover to cover. It had all kinds of oscillators, Colpitts oscillators and Hartley oscillators and a lot of other "modern" circuitry.

They called it a radio physics course, but it was really circuits for electronics. It was a lot of fun. I went on doing things like that through high school, playing with equipment and building more complicated things as time went on. I was in high school during World War II, and it was pretty obvious that as soon as I graduated from high school in 1945, I would have to go into the military. At that time, if you passed an examination called the Eddy Test, you could go into electronic technical training in the Navy. That sounded like a better deal than going into the Army, so I took the test and I passed it. I didn't want to go through the ceremony of graduating from high school anyhow, so I talked my folks into letting me leave early, and went into the Navy, in May of 1945. My high school degree was mailed to me.

Anchors Aweigh! 1945

Captain Eddy was the name of the man who developed a training course for electronics service men. It was a crash course. The way it worked was, you went through boot camp, a short basic training of only about two months. At Great Lakes Naval Station, near Chicago, they had pre-radio, which was just fundamentals of electricity. It was a one month course held at former Hugh Manley High School in Chicago. Next, I went to Gulf Port, Mississippi for primary. That was for another three months. Then I went to Corpus Christi for seven months of what they called secondary. I came out with an aviation electronics technician rating.

The whole course lasted maybe about a year. The nice thing was that while I was finishing up, they finished up the war. After I graduated, they didn't really need more people so they put me to work at a small training airfield near Corpus Christi. All I had to do was gas planes, crank them to get them started and wait for my discharge. It was a pretty nice way to spend the war and out of that I got the G.I. Bill. They gave you a year plus the time you'd been in the service. I'd been in the service for a total of sixteen months, plus twelve, made a little over three years of college that I was entitled to. That really helped because my folks didn't have enough money to pay for my college.

I later found out that my HP friend Cort Van Rensselaer also took the Eddy Course, and his experience was very similar experience to mine. He took the course and then they didn't know

what to do with him, except that he got his ROTC commission, and they sent him to Hawaii to wait out his time to muster out.

Valparaiso University, then Purdue, 1947

Altogether, I was in the Navy for 16 months, from May, 1945 to August, 1946. As I left the Navy, I could have gotten into the Fall semester of '46, except all the schools I tried, were full. All the WWII G.I.s were coming back, and you just couldn't get in. It was obviously going to be a long wait. Then my dad suggested Valparaiso University, which was run by the Lutheran Church. Valparaiso is in northern Indiana not too far from Chicago.

When I started college, the father of a good friend of mine, Irving Zelade, who was in charge of the Missouri State Highway Department in Macon, asked if I would be interested in working as a calculator or computing assistant there. Of course, calculators and computers weren't invented yet, so we used adding machines and mechanical "comptometers" for our engineering computations. During the Fall of 1946, I did drafting for them, and also calculations on "cut and fill" highway cross sections. They used those calculations for layouts of proposed highways. It was good experience, and heavy on math.

There was no problem of getting into Valparaiso, but they didn't have a four year engineering degree. However, if you went there for two years, they had an arrangement, whereby you could transfer to Purdue. I couldn't have gotten into Purdue directly because of the waiting list and the priority of Indiana people. Going to Valparaiso seemed like a logical thing to do, so I went for two years. I started in February of 1947 and just took the first two years of general engineering courses. They had moved some dorms in from an Army base, and these were all filled with ex-G.I.s. I went there for two years, and then I entered Purdue in my junior year. I got some credit for being in the military, which was my technician rating. You didn't have to take physical education, and there were a couple of other things they gave us credit for. So I entered in as a junior plus, and I actually finished up in a year and a half with my BSEE degree, in June, 1950.

My college social life was pretty uneventful. I always got pretty good grades, and after about a year at Purdue, somebody said, "Wouldn't you like to join this honorary society?" I can't remember which one it was. It was either Tau Beta Phi or Eta Kappa Nu. I was anti fraternity. I mean, most of the G.I.s didn't want to have anything to do with that stuff. So I said, "No, too much bother." They came back later and explained what it was, and I went ahead with it then. I joined all three; Eta Kappa Nu is the electrical engineering society, Tau Beta Phi is engineering in general, and Sigma Xi is general science.

After my BSEE, I just stayed right on, to get a Master's Degree. I didn't take any vacation that summer and just went straight through. By that time, I was out of money. My G.I. Bill had run out and my folks couldn't help, so I had to earn everything. I usually had several jobs at a time. I got a job as head of a dorm, which gave me free rent. For a while I worked in the kitchen of a sorority, which gave me meals. I also made money as a bellhop in the student center where they had a hotel.

When I got into graduate school, I got a job in a lab called Campus Electronics Service. It was a service lab in the E.E. School that made electronic equipment for any other part of the university that wanted something made. The head of this service was a guy named Al Todd, a very bright and creative engineer, and there were half a dozen students who worked in there, part time.

The nice thing about that job was the tremendous variety of projects that would come up. For instance, the Agriculture School wanted to determine the effect of moisture in the ground on the growth of tomatoes. Al Todd planned most of the basic ideas for the design approach to take, but

then all the work of designing the circuits was done by us students. On that one, he obviously wanted a resistance measurement, but because of polarization we had to make an AC ohm meter.

Then, I remember the psychology department wanted something that ended up being essentially a lie detector. They wanted to measure skin resistance. An interesting project, for example, you think of a number between one and ten and I'll count. I'd put the electrodes on your skin, I would count out loud from one to ten, and I could tell immediately when I'd pass your number. There'd be a variation in resistance from your perspiration. The projects we got were interesting and varied and it was a wonderful experience.

I had to have a thesis for my Masters degree. I was able to choose a project that needed to be built and do it as my Masters thesis. It was an interesting project, I ended up teaming up with a master's degree student in the Mechanical Engineering Department. He was trying to measure the stress strain characteristics of metal as it was being punched, only done dynamically. It's different if you do it dynamically rather than very slowly because the metal breaks part way through the punch cycle.

My job was to design all of the electronics necessary to plot out, on an oscilloscope, the stress strain curve. We then could take Polaroid pictures of the stress/strain as the one inch diameter slug was being punched out of metal. Then we would vary the clearance between the punch and the die, to determine what was the most effective clearance and the most effective punch speed. To do that we used a differential transformer to determine the vertical position of the punch as it was going through. We put a strain gauge on the punch itself, that could tell the compression in the punch die, and therefore measure the amount of force applied. It had to be fairly fast, so we decided we needed to use a carrier frequency. We used ten kilohertz as the carrier frequency on both the strain gauge and the differential transformer. We used a phase detector on the output. We had a way of triggering the camera when we operated it so we got beautiful stress strain curves. He got a thesis out of analyzing all of the punch data, and I got a thesis out of describing the circuits and how the experiment was set up.

It was a nice educational project. I learned a lot of really practical stuff from all of these projects. Working there was a lot more interesting than the subjects I was studying. Transmission line theory and fields and mechanisms didn't really have the touch of reality. Here you were working on real things that real people were going to use. It was at that time that I decided I wanted to work in a company that made real products and not just in radio or electronics for its own sake.

The project's measurement orientation was important too, because it supplemented my regular course work. I think it added realism to what I was studying, and no doubt influenced my later decisions to pick Hewlett-Packard for the measurements technology. Some of the work came easy because we had to build everything in this little shop room. You punched all your chassis with Greenlee punches, and folded them on a sheet metal brake. You had to make the front panel, and the whole works, and then design it like a finished product. Also, you had to write the manual for the people who were going to use it. Altogether, it was excellent training, and I was so pleased that I had landed that work.

Part 2—My HP Years

California, Here I Come, 1951

When I graduated in August of '51, it was a seller's market, Korean War military mobilization. If you could say EE, you could get a job. There were more campus interviews than you could handle. I interviewed with many companies and received nine firm offers.

I had excellent grades. Being in the honor societies was a very, very saleable item on your resume at that time. I went back to some of the companies on the East Coast. I had an offer from Bell Labs and Sperry and some others on the East Coast. I had decided that I definitely did not want to live in the Midwest. Other than for interviews, I'd never been to the East Coast and I had never been to the West Coast. My time in the Navy had been straight up and down the country between Illinois and Texas, but I knew it had to be better on the coasts than it was in the Midwest.

At that time, my major professor was John Cage. One day he called me, and this was early in the interviewing process, and he said, "We've got this company called Emerson from Saint Louis. Would you like to interview them?" I said, "No, because they're from Saint Louis, and I don't want to work in the Midwest." He said, "Nobody has signed up to talk to them." And he was a little bit embarrassed about this. I said, "I'll be glad to go and talk with them, but I'm not going to accept a job with them."

Let me put this in perspective. When Packard graduated from Stanford, he got a job with General Electric, back in Schenectady, and the boss he went to work for was John Cage. John was Dave's first boss. I guess maybe his only boss, because I think he was there only about a year. Then later on, John ended up being a professor at Purdue and my professor.

He was my major professor of electrical engineering for my thesis. So John had known both Bill Hewlett and Dave Packard, and he had kept in touch with them. He met them at IRE shows and other events, and he had repeatedly asked them if they would hire somebody from Purdue. Of course, HP at that time only had about three hundred people and they were not recruiting nationwide. At the IRE show in New York he again hit them up; and they said, "Why don't you pick somebody, and have him contact us and we'll see what we think about it."

So John Cage, remembering that I didn't want to be in the Midwest, said, "You know, there's this little company out there on the West Coast that you might be interested in." We had an HP oscillator or voltmeter in the lab at that time, and that's about all I knew about the company. The company was in the right place, so I wrote a two page letter to Bill Hewlett. I outlined how I'd gotten into the Navy electronics course, and then I told them about what I'd taken in college. I described several of the projects I'd built with the Campus Electronics Service.

Interestingly, there was never a phone call between us, and they never invited me out to interview. But I got this letter back saying, "We would like to offer you a definite position as engineer in our laboratory." They didn't offer to pay my way out or anything. But it had a nice appeal to it, so I wrote back and accepted.

Click on the link below to read Hewlett's job offer and my acceptance

http://www.hpmemoryproject.org/an/pdf/bob_grimm_hp_job_offer.pdf

While in graduate school, I had really splurged. I'd never had a car in my life, and at that time I had a little bit of spare money. So I spent $100 the beginning of my last year and bought a 1937 Olds. With a case of oil in the trunk, you could keep it going, and I had a great time with it that last year, around Purdue. When I graduated, I sold it for $100 and I used that money to buy a plane ticket out to Palo Alto. Talk about naive, I got off the plane, and got on a bus at the San Francisco Airport to go down to Palo Alto. I didn't even know where it was. So I got on the bus and I was standing up. There were plenty of seats and the bus driver finally said, "You might as well sit down. It's going to be a little drive." When I got to HP, I had to ask for an advance on my salary. They gave me an advance so I could pay some rent and get going.

I started at HP in August of 1951. My Purdue professor, John Cage, didn't come to HP for another 5 years or so. Those were interesting times for a green new graduate. As I recall, my salary was $300, plus bonus, which was running around thirty three percent at that time. It totaled about $400 a month.

I first rented a place at 2183 Bryant in Palo Alto, mainly because it was within walking distance over to the plant. It was only about six blocks, and a very nice place. Two old ladies had this beautiful home--it's still there-- and they'd converted a two car garage into an apartment they rented out. It had a separate entrance, so it was just great. I was there a couple of years, until probably early in 1953. After that I rented a place for a short time in Menlo Park, and then I rented a place up in Skylonda. That was up on Skyline Road, where it intersects with La Honda Rd, on its route over to the ocean. It was a great place, with a real log cabin with mortar in between the logs. But, a little cool in the winter. It had a gas floor furnace, but the main source of heat was the big fireplace.

I first met Marion in 1952, at the Heidelberg beer garden in Palo Alto, when she was on a date with another engineer from HP. In those years, the Heidelberg was a common meeting place for HP employees after work. We next had a double-date, with me first taking one of Marion's housemates. Then we started dating. We were married on July 9, 1953.

Marion and I were married at the Trinity Lutheran Church in Palo Alto, on July 9, 1953. My father, who was a minister, flew out to marry us. After the marriage, we lived at Skylonda, for a little less than a year. She was working as a school psychologist for the San Mateo County Schools. She commuted northward to San Mateo, and I came down to Palo Alto. The living was good, but the commute was over hard roads. There are now people that commute much farther than that. They come from Livermore and Modesto and Santa Cruz, all to work in the Bay Area. Those are long commutes. During the entire 35 years I worked at HP, I don't think I ever had more than a 20 minute commute to work.

The beginning of a very long life collaboration. My father came out to perform the ceremony.

In 1954, we bought a house in Menlo Park, on American Way. It was a small two bedroom house, but it was a lot closer to work, and it was warm in winter. You can imagine, coming home at the end of the day, up to Skylonda, in winter, and the place was totally closed. It was mainly heated by a fireplace. It was nice to have a place down below. Then, our situation changed, because we were taking two of Marion's sister's two boys, who came out to California to live with us. They were one-and-a-half and three years old, and we'd only been married about a year-and-a-half.

So we moved to a bigger house in Mountain View. We were young and thought we could do anything. Especially since we were handed an instant family, it was hard work. The house was pretty rundown. We painted it and fixed it up, and it was pretty nice. Soon we started having kids of our own, so we ended up with five kids. Then we looked for an even bigger place and ended up here on Parma Way, in Los Altos.

We moved to Los Altos, even though Marion's dream was to have a place up in the hills, where she could look out, and have a terrific view of the whole Bay. But we realistically figured that with

five kids, you'd be a bus driver most of the time. So, we found this place, and it was very, very fortunate to find it. It was one acre, off the street, so our five kids had their own creek to crawl in and get poison oak. And we still have a beautiful view out here, maybe not for distance, but it's still beautiful. It was a great place to raise kids, with essentially its own park. Marion was busy with five kids, but still got involved with the town, and both of us were committed to working with community activities.

1950s Engineering, Redwood Building

My first job assignment was to work for six months out in test. Ray Demere was running the test department, and the idea was to get the new man familiar with all the different HP products. I started on oscillators and voltmeters. I'd work for a week on one product and then they'd shift me to another; pulse generators, signal generators and so on. It wasn't air conditioned and I can remember in the summer, we had all these heat test racks, generating heat right behind us. It was an interesting time for me, given my background on electronics. You surely became aware of what designs worked and which had reliability flaws.


Redwood building, circa 1948.

While I was in the test department I had a few special projects. I remember, they were interested in depositing resistors on glass plates. They wanted to know the relative frequency characteristics of different configurations. I got about ten different kinds from wire wounds to regular carbon resistors, compared to these glass ones they furnished. So I measured the impedance characteristics versus frequency on all of them. I don't know if anybody ever used the information, but it was something the lab wanted.

I also worked in the stock room and some other areas for a while, and then I went into the lab. At that time, the lab was in one half of the middle room of the Redwood Building, the El Camino side of it, about 2500 square feet. There were maybe 20 of us engineers there. The whole company at that time had about 300 employees. Thirty five years later, when I retired, there were 90,000. So you know it was a very high growth period, and extremely well managed operation. When I think about it now, it was amazing that the company had grown well with such a small engineering group.

I must admit that at that time of my life, I had a wrong opinion of corporations. It was my feeling that corporations tended to do whatever it takes to win. And that they weren't, necessarily, very ethical. And that is still true for a lot of companies, but HP was so squeaky clean. They were cleaner than a lot of the other activities going on in the name of politics, or religion, and other economic activities. Bill & Dave were extremely ethical, and very respectful of individuals. It was very enlightening, and very gratifying to be part of it. Naturally, that brought out the best in their employees, too. I think their values also extended to our local communities, and because they contributed to the community, they brought out the best in those civic values.

They emphasized community participation among other things. So, later on, when I ran for the Los Altos City Council, they encouraged that. They encouraged people to be on School Boards, and otherwise be involved in civic activities, things like United Way. You still had to get your HP job done, but they really encouraged participation, outside of work. Further, they themselves volunteered for Boards and civic positions.

Brunton Bauer was the chief engineer in charge of the lab. I was assigned to work with Bill Myers, who was working on the 618B signal generator. He took the RF section, which was good because I didn't know anything about microwave, and he gave me the modulator section. That was OK, because I didn't know anything about pulse circuitry either, but it was at least low frequency. That was a good experience. Bill was a good guy to work for.

The work environment was pretty casual, although we worked hard. We did have time goals for finishing the designs, since the 618B was working to a US Navy contract. We used to have pretty good HP picnics at Adobe Creek, and the night before some of us would go out and help get things ready for the picnic. These evenings of course, turned into something like a beer bust. There we were, having a great time at Adobe Creek, late Friday evening on our own time. And here came Packard, and he was pretty irate. The very idea that anybody on a contract project, with such high priority, would be spending any time on anything except that project infuriated him.

HP 618B microwave generator.This was developed under US Navy contract, and once when we went off to prepare for an HP beer bust, Packard came along and "reminded" us about the contract urgency.

There was the time I was having great difficulty with some circuits I was working on, and I talked Al Bagley into coming back to the lab to help me out. We went back that very night. It was very interesting working for Bill and Dave those days. They could be pretty outspoken about their priorities. I remember Packard arrived out there at the picnic grounds, and the first guy he saw was Gene Stiles. Gene gave him a happy greeting and got chewed out in return. Within one month, Gene was a salesman for Crossley Associates, in Chicago. He was so mad at Packard, he went back to the Midwest. Those kinds of upsets didn't happen often, because both Bill and Dave were exceptionally humane managers.

It was a great time to be working in the lab, and I really learned what I didn't know. The one thing I'd never learned was circuit performance analysis. I'd taken fundamental courses and all that, but I'd never really analyzed the performance of circuits in a way which demonstrated their limits. You might exchange some component values, on either side of nominal, and plug in a bunch of different tubes. If they all worked, that's good enough. For the most part, the designs were pretty reliable, but it was a far cry from the solid engineering that HP achieved as the years went on. We used a lot of reference books, the MIT Radiation Lab-series reference books were invaluable. We also had lots of previously-successful pulse circuitry, delay vibrators, etc, which we would adapt. I'd never had all that kind of precursor of digital circuitry in school or in the Campus Electronics Service or in my own hobbies. It was all new to me.

Dave or Bill would come around fairly frequently, and they'd just sit at your lab bench and talk to you and go over what was happening. If you were having any problems, you'd talk it over. It was very low key. They were just very present and very constructive. They helped you talk it out and their help was almost taken for granted. They were the real technical guidance. Brunton had his own projects, and he was responsible for the stock room and other administrative duties. I think officially he probably approved the pay raises, but I think it was more just a titular situation. He never came around asking questions. He was a bright guy, but was never recognized as much of a manager. It was Bill, more than Dave, who was best for technical advice. The 618B project went well, and it was finished in about a year. It was mostly a replacement for the 618A, with better modulation specs.

My next project was working with Bruce Wholey. Somebody had an idea of accurately measuring the width of frequency in a spectrum display. Essentially what you did was to modulate a carrier signal, so that you got the two side bands. By knowing the modulation frequency, you very accurately knew the spacing between the side bands. So you could just put that on a monitor and you could measure the spectrum width quite accurately. We built prototypes, but then it was decided not to make it into a product.

Next, again working for Bruce, I got involved in frequency monitors for FM broadcast stations. There had already been a previous version. I think Norm Schrock was involved in that, and maybe Gene Stiles. It used a pulse counting discriminator, and that was the big claim to tremendous linearity in the measurement. You could measure distortion in FM and know that you were measuring it, and not contributing to it.


HP 335B FM Monitor.

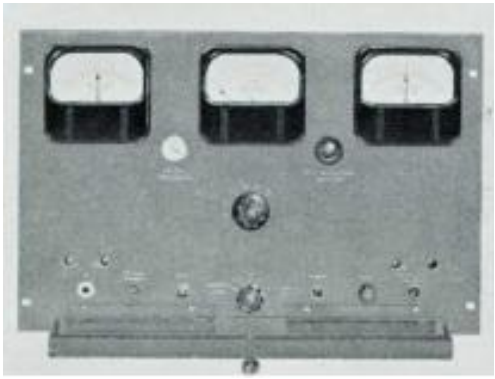
I did some work on that and then I got the job of building a similar monitor for television stations. You needed to have a monitor, not only of the FM sound part of the signal, but also the AM video. I combined them so that you could measure the spacing between the video and the oral carriers, and display them on a meter. It's nominally about 4.5 megahertz. The FM circuits of the monitor were fairly straightforward, except that we used more modern parts than we had on the earlier ones. We also had a little bit more packaging on the thing.

One of the problems on the FM monitors was that broadcast stations often wanted a remote meter to put up on the operator's console panel. But our meter operated on voltages that were up on the plate voltage circuitry, on the pulse counting discriminator. So it was about 200 volts above ground. If you happened to connect it at the wrong time, you made a motor out of the meter and destroyed it. One of the things I did was to design that display meter down at ground potential.

By that time, Al Bagley had been working on frequency counters, and had some improved ovens for the quartz oscillators. So we used the new ovens to get better frequency stability to control the crystal temperature. I can't remember what kind of a switch was in the thermostat, but one of the problems had been the oven heater was controlled directly by that switch. This was causing arcing and some failures. I used a vacuum tube to control that problem. I can remember talking to the RCA people, because this was something that would be on all the time, and would need to last forever. I asked them what the most reliable tube was, and I think it was the 6SJ7, connected as a triode. So that's what was in it. By running at a very low filament voltage, I estimated it would last forever. As far as I know, none ever burned out. It was an interesting project. It was the first one that I really did by myself, so I got to write the instruction manual. We all did those jobs, and talked to the field reps about their customers. We also trained the people out in the test department. In fact, I actually tested the first one or two runs.

Our lab of that time even dealt direct with customers. In the TV broadcast spectrum of the time, there were eighty two different channels of television. Actually it was three times 82, because there is a plus or minus ten kilohertz offset on each one. This really complicated our production planning. We had to set up a whole program for aging these special crystals. It took a long time to age them, weeks. We didn't want to wait until the customer ordered to start ordering the crystals, because then you had the supplier production times added in. We had a couple of crystal suppliers. Monitor was one, and James Knight may have been the other one. We set up a whole program for

ordering a couple of hundred different crystal frequencies, and then aged them all. We built burn-in racks, recording the frequency daily and watching them until they finally stabilized.



HP 335E TV Monitor. With the post-WWII growth of TV broadcast technology, the US FCC wrote specifications for stations to provide frequency monitoring.

I remember a couple of events of that time that were rather interesting. When there were monitor problems in the field, I was the only one who could answer them. I usually answered them by phone and talked to the field sales people. I remember there was a station up in Sacramento, that couldn't get the monitor to read right. I couldn't seem to fix it by phone, so I loaded all my test equipment into a station wagon and drove up to Sacramento.

I began measuring with a frequency counter I had brought with me, and I went through everything. I finally concluded that the monitor had the wrong crystal frequency in it. I remember calling up Bruce Wholey, who'd been working very closely with me, and told him what the channel was and what the offset was. I asked him to, "calculate the correct frequency for the crystal." He did, while I waited, and he gave me the number. I said, "That's what I get too," and that was not the number that was in the monitor. We had made a basic assembly mistake. I'd probably made it myself, and we'd ordered the wrong crystal, aged and tested it and put it in. That was rather embarrassing.

Another time there was a station on top of a mountain near Bakersfield. They called and said their HP equipment was way off, and they couldn't get it to read at all. Again I drove down there with the station wagon full of test equipment. I sample probed with the frequency counter and did all the checking around. This time I concluded the station was actually broadcasting on the wrong frequency. The monitor was working perfectly.

They said that was impossible, because they'd had a frequency-monitor service company pick them up off the air and read their transmitter frequency. We then calculated everything and found that the service was using a beat frequency technique, in which you generated a harmonic and then measured the low frequency. They just multiplied by the harmonic number. The answer was that they were off by one harmonic number. When they finally figured it out, the station guys were apologetic as hell to me, and just madder than hell at the frequency service, that they were relying on. You know, they'd tweaked them in on the air, measured and then told them to shift. So we adjusted it and got them back on their legal frequency. Of course most FM listeners wouldn't know the difference, since their FM radios were analog tuning at the time. Today's digital radios would never find such a station.

After they were back on their authorized frequency, I had all this test equipment with me and they asked if I'd mind checking all the other equipment as long as I was there. We checked the calibration on a lot of their oscillators, signal generators, and other equipment. For me, it was an excellent experience of being on the front line dealing directly with real-life customers.

In one sense, our lab and marketing groups were so small, that in those days an engineer at HP was almost a business unit. Besides designing products, you did some marketing, and training and servicing and a whole bunch of things. You were in charge of that business area. It was one of the best personal training spots you could possibly have. For instance, if you wanted a chassis, you laid it out flat, and then you went out and got the piece of sheet metal. You sheared it to size, notched the corners, taped the layout on and center-punched, where all the holes were located. You

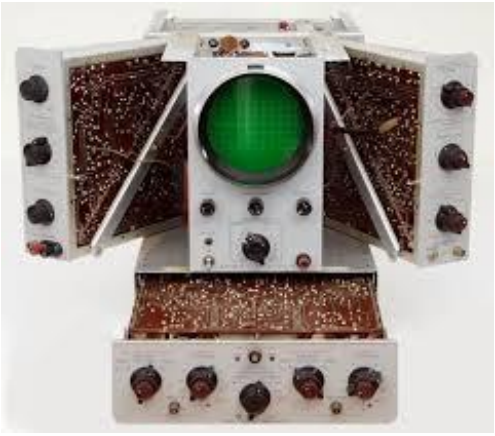
punched all the holes, and folded it up. If you wanted a clean-aluminum look, you took it over to the bright dip tank. You did the whole thing, and it was just our ordinary way of business.

For us engineers, it was a great work style, and you made the whole assembly from drawing to finish. For me, it was not only personally interesting, but it also had something to do with the kind of management we had. It was the trust that came down from higher management. I'm reminded not only of our own projects, but that management trust was also evident when Bill and Dave decided to send Ray Demere over to Europe. They just told him to start a little manufacturing company over there in Boeblingen, Germany. And they told Bill Doolittle to start the European Sales operation in Geneva, Switzerland. Doolittle came out of production, with no sales experience at all. They had a great trust in our people and what these people could do if you just gave them their basic objectives.

For the TV monitor, I was reporting to Bruce Wholey at that time. Also at that time, Dexter Hartke was involved and did a lot of the RF work. I think he did most of the RF section of the monitor. He was a fine designer. At that time Wholey had the high frequency and microwave projects. Al Bagley had his section and was working on counters separately. Keith Hunton and Pete Lacy were working almost independently of Bruce, assigned to the high frequency components like waveguides. They tried me on that technology once. That was before the TV monitor. They wanted a waveguide directional coupler. Someone had read an article and they asked me to make, what was called a beta hole coupler. It was an array of multiple holes on the flat side of a section of waveguide, which coupled power from one guide into the other. One feature of that design is that the coupled power flowed in the same direction in the second guide. I built them according to the recipe and tested them and see the performance. What the coupling factor was, and what the directionality was. Boy, I surely didn't understand that stuff, but the results were pretty good.

My next project was an oscilloscope. We had moved the lab from being just half of the middle room in the Redwood Building, to the back of the Redwood Building. It was numbered 7A. The company had expanded to two "concrete" buildings, numbered 7B and 7C. We outgrew that and then they built Building 8, the saw-toothed roof building at the corner of Page Mill and Park Blvd. Norm Schrock was in charge of the oscilloscope section, and I reported to Norm. I was responsible for the horizontal section, which was the sweep generator circuitry and the horizontal amplifier.

This project was the infamous 150A. We were all trying to be very clever and outdo Tektronix on performance. So we decided to put the CRT tube in the middle of the oscilloscope. Printed circuit board technology was just coming into use, so we decided we'd use them. We had two foot-square printed circuit boards on either side, on swing out panels. "Dumb" Tektronix used DC on the tube filaments to cut down the hum, but they had all the vacuum tubes in parallel, and we knew better than that. We put all the heaters in series and ran them with high voltage like Christmas tree strings (and the commercial radio receivers of those years).



HP 150A 10 MHz oscilloscope, showing the horizontal and vertical amplifiers on the swing-out modules. Input signal conditioning was in the slideout drawer.

That idea certainly made the power supply simpler, and eliminated a low voltage transformer. But it also gave us some hum pickup. The real fatal flaw for that time was that printed circuit boards themselves were having serious problems. They were one sided boards with eyelets you could poke the laminate off. We had no PC layout help, so we laid out our own

printed circuit boards, for the photo-etching process. We'd design them and lay them out, then drill the eyelet holes, and etch them, the whole thing. That was a very educational project.

We were finally ready to introduce our great scope contributions to the technical world at the annual IRE show in 1956, in New York City. There were two products, the 10 MHz, HP 150A and the 500 kHz, HP 130A. So we built a small quantity of each to bring to NYC. We were working night and day, literally, to get them ready and shipped. HP marketing had the foresight to have a large suite reserved at the Waldorf Astoria. We brought all of the models into this suite so that we could make sure they hadn't suffered any damage in shipment.

This turned out to be a VERY wise decision, because all sorts of wires had come off the various controls. There were lots of switches on the panel, and then these little connector pins which pushed onto the printed circuit boards were intermittent. We hadn't left enough slack in the wire and they'd disconnected. We'd brought test equipment, so we set up a whole lab right there in the Waldorf suite, and checked out every instrument, and got them all working again.

Inexplicably, New York then had the greatest snowstorm they had seen in years, a couple of feet of snow, and you couldn't even get a taxi. There were no cars running at all. I can remember carrying all those oscilloscopes through the snow over to the elevated railroad. We were showing at the New York Armory, which was way up north in Manhattan. We had to carry all this equipment over to the elevated and take it up all that way. Everybody on the train hated us because we were taking up so much room, and they were crowded because of the storm. We got up to the Armory and we got through the show and demonstrated our great contribution. It went fairly well.

After the show, I remember several of us, including Packard, myself and Norm Schrock went up north to IBM. We took the two new models up there in the car, and when we arrived, either the 150 or the 130 wasn't working. Packard was the marketing guy, and he was doing the presentation. He did all the presentation with both instruments sitting up there, but he said, "For the economy of time, we'll just demonstrate all the features on this one instrument. They're both the same except for the difference in the vertical band width." Nobody knew the difference. I don't think we made the sale, Tektronix was so entrenched.

Driving back, the roads were slipperier than hell. I was driving. We came down a hill and the car went into a skid. We did a complete 360 ground loop, and ended up on the shoulder. Fortunately, we didn't tip over or anything like that. Packard looked over and said, "I'll drive."

Of all of our various lab projects, oscilloscopes were the most challenging. It is company legend that initially HP did a lousy job of implementing scopes. We were up against a competitor who had done a very good job, and we didn't really build on what they'd done, we just tried to be different. We didn't really have much contribution to make, that was better than what was already out there. I think that that was a real weak situation. However, our 120A and 130A low-frequency scopes did fit a profitable niche where Tektronix had not occupied.

It was much different from the situation later on, when we got into spectrum analyzers. The competitive ones on the market from Polarad and other companies were not good. HP came out with the HP 8551A, and due to an excellent engineering job, and the marketing perception of it, made it a winner. It had a calibrated vertical and a calibrated horizontal display. These were performance things you could really measure with, and it was an excellent contribution. In the oscilloscopes, we just didn't do this, partly because some of our Sales Reps had lost the scope line when Tek went with their own in-house field engineers. So the project was rushed. This situation continued on for a number of years. It wasn't until we got into the HP 185A sampling oscilloscope that we really made some basic contributions that gained us a viable scope position.

We probably should have gone to the following New York show, a year later. I think we had decided we could be ready technically, and we probably advertised that it was. It wasn't our normal, conservative approach, that we should have had, and particularly in a product line that we didn't know. Bill and Dave were totally knowledgeable (and realistic) about where we stood, because I can remember that last night, before we went back to New York, they were in the lab until way after midnight with the rest of us tweaking the demos. So we were all in it together. We had made the commitment and, we were going to show it.

That was particularly painful, I think, because one of the big features we put in our first scope ad was "reliability," and due to the rush, it was not nearly as reliable a scope as we would have liked. We tried to do a lot of things, like the delay line for the vertical signal, so that you could pull off a trigger, and be able to trigger on the signal you're looking at. Tektronix had a discrete component delay line and we decided that was a clumsy way, and we'd just put in a hunk of cable. We got some delay cable and put in a piece about a foot long. That was probably okay to do that because it's bandwidth was not bad, but in a lot of cases we were just trying to do things differently for the sake of being different. That's very dangerous.

The Arrival of Barney, 1952

There was another interesting period in my life. It was the year when Bill and Dave were able to convince Barney Oliver to leave Bell Labs, where he had worked during WWII. He would come to HP, as the Director of R&D, and later as VP. This would have been about 1952. He came some time before the lab moved from the Redwood Building over to Building 8. Building 8 was located at the corner of Page Mill and Park Blvd, closest to the railroad crossing. While we think of Barney as a scientific genius that he was, it was Barney who invented the standardized HP lab bench design that we used for many years. The new building was outfitted with those.

He regularly came around to talk about the projects, but at the same time was evaluating his engineers in his R&D group. He was probably tremendously chagrinned about all the nincompoops like me, who didn't understand any of this analytical stuff, as he tried to explain poles and zeros. So he set up weekly lectures on different topics that we should have already known. He also included some very effective demonstrations.

The one that I still remember was on square wave testing, because that was really hot stuff at that time. For characterizing an amplifier performance, the standard method was to run a frequency sweep, to determine the response curve. But, instead of sweeping across with sine waves, he said, "Why don't you just put a square wave input, and if the output comes out square, your frequency response is in good shape." Everybody acknowledged that was true. He had a demo black box, and he input the square wave, and looked at the output on the oscilloscope. There was a nice square wave. He changed the frequency just flipped the range switch ten to one. Again, there was a nice square wave on the scope. He did that several times and said, "What do you think about the frequency response?" We said, "Flat."

Then he replaced the input square wave with a sine wave and the response went up and down and up and down. He had all kinds of tuned circuits in there that we were totally missing, by the harmonics in the square wave. It was the weirdest up and down type of thing. But by choosing the right frequency for the square wave, which he had done, he just straddled every one of them. We all learned that Barney's specialty was math transforms, from frequency to time. And he was very adept at converting from electronic to mechanical or fluid systems. If an electronic circuit was misbehaving, he would mentally convert to say, the mechanical analog, and think it through that way.

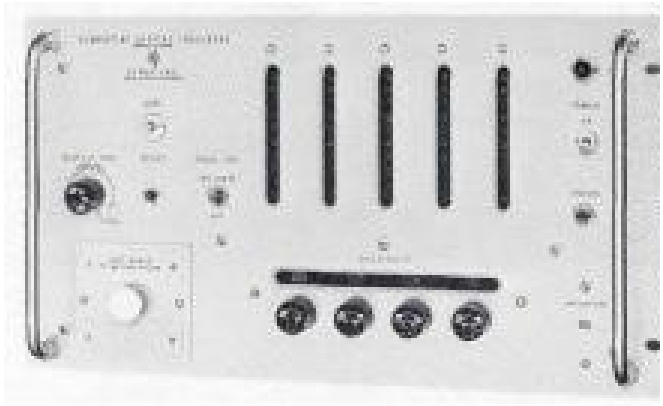
I can remember his lecture on reflectometers. This explanation also involved seeing the difference between inductance and capacitance and resistance, in a transmission line, and how to detect all that by just the wave shape. It was pretty fantastic to have such a brain as a backup to our scientific advances.

The Birth of Dymec, 1956

About 1956, Bill and Dave decided there were opportunities in the measurement systems business. They wanted to be able to take advantage of HP's knowhow and technology in our products, and leverage that into a systems business. They had hired Bob Rawlins from Lockheed, down in the Los Angeles area, to come up and head this new operation. All along, whenever I had talked to them, I had always expressed an interest in getting into industrial electronics. That's what I had wanted to do before I joined HP, and all the projects I worked on, like TV monitors and oscilloscopes, weren't really industrial electronics. It was just test equipment to test other electronics.

I don't know whether it was to get rid of me from the lab or not? But they said they were setting up this new division to do systems work. Would I be interested in doing that? I quickly said yes, without knowing much about what they intended doing. It sounded to me like it was a lot closer to real electronics than what I had been doing. They told me they'd hired this guy Bob Rawlins, and I would work for him. I said, "Fine, I'll do that." I was sitting at the Editorial bar in New York City, having a drink, and that's where I met Bob Rawlins. I said, "You're the guy I'm going to work for." We hit it off, so after I came back from the New York show, I transferred over to work at Dymec. There were just Bob and Dave Stead and maybe a couple of other people at the beginning, so I was probably number three or four person to go over there.

I got involved with a special counter that Al Bagley's group had as a pet project for a long time. We ended up calling it a computing digital indicator (CDI), because it was a frequency counter with an adjustable time base. It was intended to take over a product sector from EPUT (events per unit time of Berkeley Scientific). We thought CDI was going to do it, so we built this frequency counter, and then provided at the bottom, knobs that could input either four digit or five digit numbers. These number inputs essentially adjusted the time base so that it multiplied the normal display by a selectable constant. This was a powerful feature because it allowed the display to show actual engineering units. Thus it was particularly useful for physical measurements, like pounds per square inch or RPM or whatever.



DY-2500 computing digital indicator. The knobs set in a selectable time-base, so the display could directly read out physical units, like PSI or RPM.

So a person couldn't accidently dial in the wrong number, we also had plug on the front that could be wired with a constant number in it. When it was plugged it in, it couldn't be changed. So that got us into the industrial type of things. Al Bagley coached us throughout that whole project, with his electronic counter expertise. We used the standard F&T division output staircase it to drive printers. It was a darned good product that got us into a lot of industrial applications. Later on we offered other transducers, like a pulse counting tachometer which had a little etched wheel and a photodetector that would put out 360 pulses per revolution. We counted that and measured RPM.

DY-5001 scanner was a data acquisition winner for aerospace structure testing.

Then customers began to slowly get us into the data acquisition system market. It was not too slowly, because Bob Rawlins was pretty aggressive on selling. The very first system that we sold was to Boeing. These were big days for aerospace, and they had to do an enormous amount of airframe performance testing. It was the DY-5001 system and it was intended to replace their current wind tunnel measurements of air pressure. The conventional way they were doing it on wind tunnels was with whole banks of manometers, each of which were measuring pressure drop across the model in the wind tunnel. They would photograph each channel and then take it off by visually reading the manometer photograph. On a one-shot, blow-down wind tunnel, there was a finite amount of time before the pressure tank ran out of air. So they went through this tedious process of taking a manometer photograph on one model position, change the position of the model, take another photograph and then later on read all this information off.

The idea with our data system was that you could do this all automatically. There was a pressure transducer product, made by Byron Jackson Company, which they called a Vibratron. It depended on a resonating wire, attached to a diaphragm. As you increased the pressure on it, the wire became slightly more slack, and therefore, the frequency dropped. However, it wasn't linear, so this got us into some calculations to do data corrections before recording. We built electrical circuitry that could take that curve and make it read out directly. We used the circuitry of the computing digital indicator to make the corrections, so that the thing would read out correctly. This system had twenty or thirty channels of pressure transducers, and then the corrected outputs all went to magnetic tape where we recorded the combined data output. We had to have a box that would put all this data together, and format it onto digital tape, to be read back later. It was about a six bay system and it was quite a challenge.

It was interesting that as time went on, and we built more and more systems, into standard rack cabinets, that we later were surprised, that when we priced out such systems, the price always came out quite close to $1000 per vertical inch. So a 6-foot high rack full would be around $72,000. That turned out to be true whether it was full of microwave instruments or data acquisition instrumentation. Fascinating.

The first data scanners we built were stepping-switch scanners, using telephone-technology stepping switches, but they were fairly slow. One reason we did that was that that technology was old and VERY reliable. We used those switchers mainly in voltmeter systems. Their electrical contacts were gold plated and had relatively low voltage offset, so we could scan up through twenty five points and connect it into a voltmeter. We could then record on an HP printer, both the channel number and the reading on the voltmeter. Later, moving up performance from the stepping switch scanner, we started designing in the cross bar scanner technology. Again it was a telephone standard usage, and we could handle something like 100 by 100 by 6-wire connections, or 200 three wire connections. They were faster than a stepping switch. They could also be random accessed, if you had a way of programming the switch. Then, much later, we got into Reed relay scanners, which were much faster.

As Dymec started, I joined engineers Dave Stead and Jack Humphreys, all there within a couple of months of each other. There was no particular assignment as "Chief Engineer," it was just a small

group of busy engineers, just out of default. But what happened was that soon after we designed the early equipment, the same engineers had to build it. Initially, we were all in the very front room of the Redwood Building, which was 1500 square feet, and initially the production line was right down the middle of the room. We had Nelly Monsees and Zella McFadden and a few other women transfer over from HP to do the wiring.

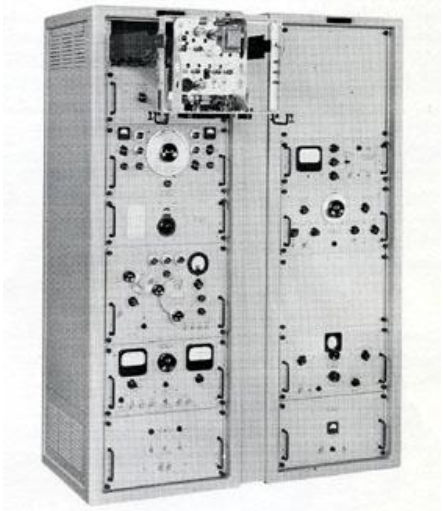
When people needed something, I started getting it for them. If we needed equipment, I would order it and I slowly worked into the production details. Then when production finally outgrew the Redwood Building, we rented 440 Olive Street, and we moved the production over there. We obviously needed a purchasing agent, so Dale Dewitt transferred down and ended up reporting to me. Then we needed production control, and Fred Becker transferred in to handle that. Soon we ran out of space again, and I found another building at 440 Pepper Street and rented that. It didn't have a bathroom, so I designed a bathroom, and got it installed. Our stockroom was conveniently in the next building 7B, and we outgrew that, so I rented a building down at the corner of Park and Lambert. Again I had to go in and design and build a toilet and do the lighting and move the stockroom down there. So, as you can see, I was just kind of assuming the role of Manufacturing Manager.

In the meantime, as production boomed, we wanted to do our own sheet metal work, so Gordon Smith transferred over from HP and he and I worked together. He'd tell me what he needed, and I'd order the equipment to set up a sheet metal shop. We got Jack Tennison to run the sheet metal and Gordon was over all supervisors. He also built our machine shop. We outgrew this, so we went out and rented another building on Park Ave. It was crazy, because at one time we had five different addresses in South Palo Alto. We used a little electric cart for transport between buildings, and then we bought four or five bicycles so that we could ride between the places. We just had a great time throughout that whole period. The group over at 440 Olive, which was mainly the wiring and assembly and for a while, the test group, was very close knit. I was over there frequently and we got along very well.

We had two sets of production processes. For products that would be made in small quantities, we had the people who had regular wiring & assembly skills. They worked from a sample model and just copied it. For the one-off quantity, we used electronic technicians who worked from schematics. They were real craftsmen, and did beautiful work. The engineers would just draw up circuit schematics and give it to these technicians. They would come up with shippable, first rate quality. In one sense, Dymec products were a bit like the work I did before, at Purdue, when we designed and built custom electronic equipment for the other school departments.

It was satisfying to me that the people of Dymec were able to exist in two product markets. One of them was our "standard product" business, where we would go through the normal HP new product process, with prototypes, and a concern for production thinking, serious documentation, etc. That example would be the DY-2401A digital voltmeter, which was sold to customers individually for integrating into their systems. The other part was the digital data acquisition systems. These consisted of a scanner for connecting to the customer scanner points, then a system-oriented voltmeter or frequency counter for making the measurements, and then various output storage devices. These might be punched paper tape or digital printers, or magnetic tape and other recorders. We sold most of those system elements, either as individual components or we combined them into systems.

Another part of the systems business, which we were pretty good at, was a microwave signal simulator that was configured to check Doppler radar systems. At that time, HP did not have programmable frequency synthesizers, or other ways of generating precise microwave frequencies. For the Doppler performance, we wanted to simulate the radar return echo from a moving target. That meant that the return frequency was slightly offset from the emitted signal (Doppler effect). So we came up with what was called the serrodyne technique, which was accomplished by modulating the helix of a traveling wave tube (TWT) amplifier with a saw tooth. As we did this, the phase of the TWT output signal would vary, because it was proportional to the voltage on the helix. When the microwave phase shift got up to 360 degrees, the sawtooth snapped back and then repeated. So you had a microwave output frequency that was offset by the modulation frequency, the repetition rate of the saw tooth. That offset represented the Doppler offset, which we needed to test, and was able to simulate the radar target display.



The DY-6190A was a radar test simulator. It used a microwave travelling-wave amplifier, modulated by a sawtooth signal, which produced a constant loss of phase, ie, a precise Doppler offset from the microwave transmit signal.

That was our basis for making signal simulators in various frequency bands to check out various Doppler radar systems. We made them in X band and C band and several others, and we sold them to General Electric, Hughes and Convair and a lot of others. They were very expensive and very sophisticated systems. We also got into some programmable parts. We needed some programmable microwave attenuators, so we designed motor driven attenuators, motor driven phase shifters and other types of passive components that were intended to be hand operated. A lot of that work ended up in classified, so we built some separate secure rooms, just for classified work in military contracts. It was a rather interesting time.

We got pretty good at "Rube Goldberg" solutions to making standard manual instruments into automated ones. For our data acquisition systems, we needed to take data into our system from Bagley's frequency counters. Fortunately Al's designers had already arranged an interface to their HP 560A digital printer, by use of 100 volt staircase outputs, one wire per numeric display digit. The staircase advanced 10 volts for each digit increase, 0-1-2 etc. While it was very economical of the interface wiring, it was not as common as a BCD code which took 4 wires per numeric digit. Our guys adapted to both standards.

The HP 5105 frequency synthesizer was precisely accurate, using the manual pushbuttons, but for programming, it required 10 wires PER DECADE.

Then we came to the HP 5100 frequency synthesizer family from Bagley's F&T Division. Customers needed this capability for programmable stimulus signals for their test systems. The synthesizer had ten push buttons on each decade, so there were ten wires for each decade of the frequency input. We at AMD had pretty much standardized on BCD code, so one of our first custom designs was a decoder from BCD to ten wires to run the synthesizer. This was needed for all 10 digits of input of the 5100.

The name of the game then was that very few of the products that HP made were very system oriented. I'd say that the digital output from counters was very much on purpose because they had to drive printers. External programming on anything else around HP was almost an afterthought in most cases, including most of the other counters. They had knobs on the front panel, but if we

wanted to change the gate time, it was just too bad. We couldn't go inside the box to replace a multiple layer mechanical Oak rotary switch. So Dymec just accepted that as a given, the fact that one of our roles was to take instruments as they were, and modify them. If we couldn't get the division to modify them or the external supplier to modify them, then we'd modify them so we could control them, or get data out of them.

We built programmable "knob turners." That was the outgrowth of some of the work we did on the microwave signal simulators, where we were turning attenuator shafts and turning phase shifters and things like that. So we designed motor driven shaft tuners, with optical shaft encoding for precision settings. We adapted that to other types of instruments. Whatever it took to get the job done was essentially our task. Most of the divisions just didn't want to be bothered with such modifications because the volume was so low.

But Bagley remembers that finally the message came back to the divisions. They kept hearing from Dymec more and more, and other customers, that there was something to do with systems that made measuring automated. These persistent rumors finally stimulated somebody to say, "We ought to have something like a common programming language so we can talk between instruments."

And it wasn't just Dymec though. The world was going that way and all of the internal system houses of the major companies were wanting the same thing. So it was a ground swell everywhere; but unfortunately, for many, many years every instrument had a different interface. It was much, much later that the HP Interface Bus came along, with the idea that you should have a standard interface. Dymec just went at it and sometimes it was more than just a simple connection.

I can remember particular problem instrument was the HP 8405A. It was a 2-channel RF Voltmeter to 1 GHz, with also the measurement of the RF phase between channels. It was supposed to lock onto the test signal coming in. We would program a signal source, then we would get two analog signals that we could run in, and measure. But sometimes it wouldn't lock on the test signal, and that was disastrous for an automatic system. I can remember talking to the people in the Stanford Park Division. We tried to figure out what to do, when it would occasionally just not lock in. The engineers said, "Well, you turn it to such and such and then you turn it back. If it doesn't lock in, then you try it again." So what we essentially built into the software driver, in case it didn't lock in, was a good kick.

Back to management. The hiring of Bob Rawlins from the outside, to manage a division was unusual. Up until that time, HP almost never hired a management person with a lot of experience, from the outside, and put him into a fairly key job, like they did with Bob Rawlins. I guess bringing Barney Oliver into HP Labs was a first, but he was a personal buddy from their days at Stanford with Bill and Dave. We almost always said we wanted to grow our own talent. But I think Bill and Dave had known Bob, at Lockheed, for some time before. He was probably a customer, and they shared a mutual respect. Bob also had very much of a can-do attitude. He would go out and commit to all kinds of complicated systems, and he had no fear of negotiating. Compared to most of us around there, who were just engineers, he would not hesitate to do estimates and calculations, set a price and specs and sign the contract. So he was someone HP needed at the time.

Bob and I got along extremely well. I learned one helluva lot from him. Traveling with him on the road was an adventure in itself. His internal clock ran different from most. Being in a plane five minutes early was wasted time. He was extremely uninterested in the actual engineering and manufacturing. He seemingly could care less how things got designed and built, no matter the complexity. That turned out great for me, because anything that I decided to do was fine with him.

I ended up becoming the manufacturing manager, more or less out of default. I just got out of the engineering part of it, and we just built stuff, tested it and shipped it. That was fine and I got great satisfaction out of doing that. We had a lot of fun, and the relationship with Bob was just great. I liked to set up parties, so I ended up running the parties and the beer busts and the picnics. While we worked REALLY hard, we had a fabulous time. Dale Barger was head of the microwave engineering. Harry Schultheis was in charge of the digital stuff.

Ed Morgan headed marketing, although Bob, himself, really did most of the sales end. Ed would handle the old-HP part of the standard products. At that time we had Sales Rep organizations, and annual negotiations with the reps was an ongoing activity, particularly on commission rates. One good thing was that Morgan was on good terms with Noel Eldred, who was the main HP connection with the independent Rep companies. Ed's step-father was Frank Cavier, V.P. of Finance. With these custom systems, the reps could only be a finder, because all the customer negotiations had to be between the customer technical staff with our own Dymec engineering. Bob usually led those negotiations, along with our people in the engineering department.

The real challenge came when Rawlins would have to quote not only price, but fixed delivery on something that had never been made before. Engineering would get consulted, and we had to lay it on the line, and try to come out right day in and day out. To this day, being in the custom system business is one of the toughest engineering environments around, because you can estimate correctly nine times out of ten, but if you guess wrong once, you can wipe out all the profit on those first nine with that one bad guess. Further, we didn't get a lot of repeat business for the same systems.

For a few of the systems, like the signal simulators, going into some of the ongoing military programs, we got a number of repeats. In fact, we even got re-negotiated on one G.E. contract, because we made too much profit. So, you know, it was sort of a can't win situation. If you lose, that's tough; but if you make too much, they might make you give some back. These contracts were not like a normal purchase order, they contained government-demanded financial reports, which revealed just what the unit profits were, and often required returning excess profits. If we charged all the R&D expense on a single contract, and then used that technical expertise to sell multiple systems, it got complicated for our contract managers.

We certainly did sell some standard systems, incrementally, although by and large it wasn't a whole lot. I think we satisfied almost all our customers, we certainly worked hard to satisfy ALL of them. Technical customers were after HP all the time to supply test systems, particularly the military. I think Bill and Dave felt a certain obligation, particularly to the military people. Bill, of course, had enlisted in the Army during WWII. His job was to manage the advanced radar and electronic warfare needs of the services. From the Pentagon, Bill helped guide the engineering of DuBridge's MIT Radiation Lab (radar) and the Terman's Harvard Radio Research Lab (EW).

The division did make a profit. Usually it was not as much as profit on standard sales like the rest of the HP Company, but it was acceptable. It also allowed some of the older employees at HP to financially invest in Dymec, as they'd done in PAECO before. That was a nice added job bonus. Further, most of the systems used a LOT of standard HP products, which WERE highly profitable.

Before the HP 2116A Instrumentation Computer, when we needed to do some required mathematical calculations, we were doing things the hard way. I can remember one of the very first times we had a data acquisition system that needed some data calculations. It was for Westinghouse, and what they had was a test sphere, with total reflection inside for testing the light output of commercial light bulbs. You could put the light bulb-under-test anywhere inside, and the light would bounce all over. Then you would sample it at a tiny opening, and measure the total

integrated light output. All they wanted to do was measure light output divided by electric power in, which was voltage times current. You had the not-so-complicated complicated equation of A over B times C.

Just before that, believe it or not, we had literally built some systems with standard adding machines on the output. We designed a solenoid bank that could punch the keys. That gave us a machine that would punch the buttons and do some calculations. But we couldn't find any ten-key type of mechanical calculator, where you could take A and divide it by B and then take that answer and divide it by C. We could take A times B and divide by C, but it had no way of re-entering the first result.

That was when we came across this first desktop calculator called Mathatron. It was made by an outfit up near Boston and was called a desktop calculator. It could actually do that kind of a calculation because it was an honest to goodness calculator. It was an unusual design because its output was like a tickertape, half inch wide tape that just printed out the numbers. You had to read it like the old stock ticker tape. The digital output was an "excess three" code. I remember talking to Al Bagley, at that time, about how to interpret that numeric code, so we could feed it into a punch paper tape. It was an odd code.

The Mathatron, made in Waltham, MA, was the first programmable electronic desktop calculator, which we needed for data manipulation. Its data output went to a punched paper tape, just like a Wall Street stock ticker.

That box, plus the adding machine with the solenoids, were our first approach to trying to add some computation. It's a little laughable now in the 21st century, but that was the status of our creative attempts to get a computation job done. We'd also gotten into more sophisticated boxes for controlling the signal scanners. The original ones had diode pin boards in them, which we would set up to program the ranges that we wanted, whether the source was DC or AC, volts or ohms, which frequency range. The diode pin boards were all a hard wired type of programming. Then later on, as other programming technology emerged, we would grab that process to make our systems more convenience and flexible. What we REALLY needed was a computer, still to be invented.

A final note to the Mathatron. The name "Mathatron" was coined by the founder's wife. The inventors would go on to obtain a patent on the design of the Mathatron's algebraic logic system. In a fascinating twist, this patent would later be bought by Hewlett-Packard, which ended up in the HP-chosen Reverse-Polish-Notation (RPN) logic system for the HP-35 hand calculator.

The diode pin board was a type of cross matrix. It was typically about seven inches wide and maybe five inches high. Across the top were the programmable measurement channels, 1 through 25. Then down vertically below were all the selectable parameters, voltmeter ranges like a 0.1, 1.0, 10, 100, 1000 volts. Then AC or DC, and other common parameters. To program the scanner, you would plug in these little pins at the intersections where we wanted to program channels. Let's say one of the scans was to be a ten volt reading of DC, we'd put in a pin there. If the next scan was to be on the hundred volt range, we'd put a pin in there. Some of the pins were diodes and some were just metal pins.

The beauty for the customer was that the pin boards were easily interchangeable. We could do one particular test run and then we could reprogram it very easily. Just change the pin board. They were quite reliable. They worked well and they were very popular.

Back to the division. Rawlins decided to leave somewhere in the late 1950s, maybe 1958. I'm not sure exactly why, although in terms of the normal HP management style, he was pretty much of a renegade. I'm pretty sure he was also perceived that way by Bill and Dave and probably by Ed Porter and Frank Cavier, Ralph Lee and Noel Eldred, all of them. It was not very evident to me exactly what their perception of him was, but one day they simply announced that he was no longer going to be running Dymec. He was going to go on special assignment, reporting to Bill and Dave. Cort Van Rensselaer would be the new general manager of Dymec.

Rawlins stayed on for six or nine months, and finally decided he wasn't doing anything that was challenging to him, so he left. He then got involved in a lot of investing. I think he came out okay financially with the deal, although I never knew the terms. He also got involved in the electronic rental business, and he once said to me, referring back to that, "You could never tell a good break from a bad break until much later." I thought that was a rather interesting comment.

As hard as we tried to exploit data calculations using the solenoid-driving adding machines, and then the Mathatron, we were really waiting for mini-computers. And along came the PDP8, a new affordable computer made by Digital Equipment Corporation. We had purchased one or two of them for serious evaluation. Bill Berte was the man working on that project, under Don Loughry. They were making good progress with the exceptional flexibility you could get from the fact that you could change what it did and control it. You could also process the data. It just was a revolutionary change in the way we handled system architecture. The signal paths didn't change, but certainly the controlling and the processing of the data changed vastly. It was a no-brainer that we concluded that computers were in our future.

Before that, we had done something that I felt very good about at the time. We tried to approach the data acquisition system selling process with a standardized approach. The vision was to set up the specifying process, such that we could sell at the field marketing level, without having to do all the engineering on a custom basis, one off. And to avoid getting the factory into each price quoting step. We came up with a system data sheet that basically was a modular, choose this, add that, for this price. We called this product line the 2010 series data acquisition system. It was based on the standard voltmeter, a scanner and certain optional add-ons. The beauty was that we could spec the performance characteristics, no matter which combinations of modules the customer ordered. It was probably the first attempt to standardize the ordering of system. The field sales engineers were delighted, since it avoided protracted negotiations with the factory. In fact, it went into the HP annual catalog.

When Cort Van Rensselaer became Dymec Division Manager, I stayed on as Manufacturing Manager. Cort was general manager for about 2 years. During that time, Bill & Dave decided to set up the oscilloscope division in Colorado Springs. Then Cort was identified as General Manager for the oscilloscope division, and they started by moving their production down into Buildings 7B and 7C, which were called the "concrete" buildings. They were alongside the Redwood building. As Cort took over those responsibilities, they asked me to head Dymec, which came as a total surprise to me.

As often happened at HP, it was done very casually. Ed Porter just came down one day, and was walking around. He just came up to me and said something to the effect that we're were going to set up an oscilloscope division, Cort was going to do that and we'd like you to be the Dymec

General Manager. I said okay and that was all the fanfare there was. That would have been about 1962.

My tenure as general manager was great fun, probably more so in hindsight. When things were going well, it was a pretty happy crew. Our people had a good time, and in general, we had a pretty good camaraderie. And yet, we got our a** in a sling a number of times. There was one project with White Sands, some kind of a signal generation or signal measuring project up in the microwave range. We had been struggling on that project for a long time, trying to meet what we'd agreed on for the performance standards. I kept getting, "We're almost there," from the engineers, but finally, I took the problem to Barney, and laid it out for him.

Barney analyzed the whole problem, and finally came back and said, "What you're trying to do is mathematically impossible." We had many meetings, because we were so far behind schedule, and we had been making promises and more promises to White Sands. We finally had to fly down there and personally negotiate a cancellation of the contract because we couldn't perform. Those were some of the times that tried men's souls. By and large, though, I'd say it was a pretty happy time. The fatal flaw was pretty complex, something to do with noise figure. And yet, as the customer agreed to cancel the contract, they noted that it was important that their own technical knowledge was advanced by knowing that their request was impossible.

Enter the 2116A Computer

The HP 9100A desktop calculator had introduced in 1968, and was sent to Colorado to manufacture. It was a huge success to the science community. Kay Magelby had been working at HP Labs under Paul Stoft, which was also the birthplace of the 9100A. Several years before, Kay had the idea that HP ought to make a general purpose computer for instrumentation purposes, not unlike in size and capability, the Digital Equipment Corporation PDP8. Initially Dave didn't see HP in the computer business. But they were finally convinced that an instrumentation-oriented computer would be good. They looked around and asked if Dymec would like to have a computer down at our place.

The HP 2116A Computer featured a 16-slot card cage on the lower third, which provided the PC boards which interfaced with measurement instruments.

We had already been working with DEC, and knew the power of the PDP8. In fact, we had developed a data acquisition system based on the PDP8, and were going to take it back to the 1965 IRE Show. We had ordered ten PDP8s and had already accepted two of them. We then decided to drop this project because we were going to make our own computers internally.

So, perhaps because of our PDP8 experience, the decision was made to start up a computer group, and put it within Dymec rather than giving it to Colorado. I think Al Bagley might have pitched to have the project transferred to F&T, because that division was all digital. Anyway, that pitch didn't work, and the project went to Dymec. Kay Magelby was chosen to head the R&D effort. The opportunity arose at that time, to acquire some assets of a small digital group at Union Carbide back in Detroit. Kay and two others went back to assess this opportunity because, Union Carbide wanted out. Computers just weren't for them. This small group was called DSI. It was felt that they had some

good people, and maybe some fairly good ideas in their prototype, that would be useful. HP acquired the assets of DSI and we ended up bringing out four or five of the key people.

The computer team we put together ended up being pretty darn good. Kay did an excellent job of managing the group, and, their product became the 2116A computer. One of the people who came from DSI was John Koudela, who went into marketing, and the rest went into the R&D. Joe Olkowski was good on memories. Dick Reyna, who was part of Dymec's R&D, worked on the I/O part of the computer. Arnie Bergh did the memory section and there were a couple of others.

We didn't have any people in software, so one of the first priorities was to find somebody to head up a software group. We finally hired Roy Clay, from Control Data, and it was soon apparent that Roy was an excellent choice. He had lots of energy and was very intelligent. Roy and Kay proceeded to hire the rest of the software group. They were a very hard working group of people with a very demanding schedule.

When we ran out of space we rented a trailer and parked it right outside Building 8, the saw toothed roof building. That became the offices for the software team. We only had a couple of mainframes, so Roy talked the software people into working shifts so they would get maximum access to the computer for developing the software. They had to do the operating system and I/O compiler and assembler. They were a dedicated crew and they came up with an I/O structure and I/O hardware which were outstanding. The idea of having one card for each external device and putting all the customization on that one foot square board was a great idea.

We finally introduced it in 1966 at the IRE Show. Leading up to that show, the field (At that time we had four regions in the United States.) didn't think much of the idea of computers, which was natural since their field was instruments, and they saw it as a distraction. The idea that the regional offices were going to take any of their good field engineers and have them waste time selling computers, when they could be out selling instruments wasn't flying.

It was finally arranged that each of the four regions would choose one person to be their computer person. I know Neely didn't want to waste even one of their good people. Al Oliverio had been trying unsuccessfully to get this buddy of his into Neely for many years, so they said, "Let's bring him in and send him up to Dymec." The deal was that each of the regions would send a person to work at Dymec, on the finalizing of the computer, and writing the marketing material. Then they'd go back out in the field with a computer to demo, and do the selling. In turn, they would train other salesmen. But there was just no appreciation at all from the field, of the idea that this could be a significant new product on the market.

At the time we introduced it as a computer, it had a core (miniscule ferrite donuts) memories bought from Ampex that were 4096 words. It was a 16 bit processor, that used an ASR 33 teletype as an accessory, that you could read in and type out. The mainframe was something like $18,000, and we had an optional additional 4K memory which was another $4,000. To me it's rather interesting that an equivalent 64K dynamic RAM you can probably now buy for ten cents.

Most important, at that time, Dymec's Data Acquisition Lab developed and introduced a computer system using the 2116 for their data acquisition. The Microwave Division came up with their first 8540A automatic network analyzer which was just a real winner. It did a superb job of calculating all the errors and taking out all the errors for making microwave impedance measurements. Of course, it also controlled all the various instruments, signal sources, switching, and the basic 8410 manual network analyzer, which was the basis for the system.

The 2116A project at Dymec moved very fast, and development was only about one year. And that included environmental testing. One of the foremost goals was that this computer would meet HP Class B environmental standards which basically said that it could be installed out on the production line floor, and not have to be babied. At that time, most computers were sensitive to temperature range and everything else. I can remember going to a paper mill company, where the computer room was the only comfortable place in the whole plant. It was the only air conditioned spot. The idea that our computer could withstand the same environments as our instruments made all the difference in the world. This was especially important since its earliest uses were to control instruments, from its built-in card-cage.

Another real selling point was the fact that you could haul it around in a station wagon. Although it was not so light weight, you could still lug it into the demo room, set it up, plug it in, run the demonstration and it would work. I mean, we weren't babying it physically or temperature wise, and that was impressive to a lot of people.

One of the first computers went to Woods Hole Oceanographic Institute, near Boston. They wanted to be able to analyze measurement data while the ship was still out at sea. That way, instead of waiting until they got back to shore, to find out if they had good information on their data acquisition system, they could know as they measured. It worked for many years out on the ocean and that's one of the worst environments for equipment.

I have another remembrance of the technical impact of the 2116A. One of the first times that IBM became aware of our computer, was when one of their executives saw one at Stanford? I think he was high up in management, and got quite a show of the thing. He came away saying something like, "This is one of the greatest contributions to computing I've seen." He was very impressed.

There's another little thing of some significance that happened after the introduction of that computer and after it seemed to be going pretty well. The "Field of Interest" item in the HP Corporate Objectives was changed to read: We will also make computers, but those computers will be for instrument systems only. They didn't want anybody to think, all of a sudden HP is a computer company. It was very carefully stated there, that we were not general purpose business computer manufacturers.

There was quite a mystique about computers at that time. In fact, in the government in particular, if they bought something called a computer, it had to go through a whole lot of central bureaucracy to approve it. For example, PDP8 stands for Program Digital Processor. I believe DEC used that title, instead of computer, for just those kinds of reasons. Even in industrial and technology companies, the IT departments, who owned the big-daddy computer rooms, didn't want other competitive computations alternatives coming in without their management control. We debated for a long time whether the 2116A should have some fancy name like that. We finally decided, "To hell with it. We'll call it a computer, because that's what it is, and we'll take our lumps as they come."

Al Bagley also remembers something along that line. When he started incorporating the 2116A in what he called a Fourier analyzer system, down at F&T, he had troubles with customers breaking through that mystique. "My God, you're selling us a computer!" they'd say. The red tape involved in selling a computer was almost too much. Sometimes we were finally smart enough to hide the computer within the box, and not say we had a computer system at all. It sold a helluva lot more easily then.

The 2116A was not particularly friendly to use. Because of the price tag, a lot of people only bought 4K of memory, and to do a Fortran compiler took about three or four passes. Initially, it

was ten characters a second on the ASR33 teletype. Then we had a big "breakthrough," a paper tape reader that could go at 300 characters a minute. The initial development work was done at ten characters a second reading punch paper tape on the teletype. That was tedious as hell, and the odds were not very high that you could read a long roll of tape without an error.

The computer front panel itself was intimidating, with a row of about 16 lights and toggle switches. Those were used to enter a sequence of 16-bit words that were the instructions on how to read paper tape. Another of the things that was the most mystifying to me, and I think to a lot of the management around here, was all the new terminology. Almost everybody around knew hardware terminology. If you opened up a frequency counter, you would know that here was the time base, and here's the display register, and here's all the different parts. Then the computer came along, and they started talking about the compiler, and how important it was. The computer wouldn't run without a compiler. You'd open up the door and ask where's the compiler? Well, it's not real, but it's important! We went round and round and I swear that the people who were doing the software didn't simplify anything. I think they made it a lot harder because, as Barney once said, "They like to talk in code."

Much later on, I got into the understanding that there was such a thing as a core map. It happened to be when we had the great breakthrough of having BASIC interpreters, although it would have been applicable to Fortran or anything else. As soon as I understood that there are different functional areas that use up so much of the core with certain linkages between them, it didn't seem so darned complicated to understand. Then they talked about an I/O structure, and every time you add another instrument, you have to add another driver and that uses up so much space.

The whole initial concept was very frustrating for everybody. When we got into relocatable code and multi passes, it was a miserable time for all of us old hardware people. Further, for Bill and Dave, and a lot of the upper managers, and the marketing people it took time to learn and understand. It certainly was for me. I took a computer course on an IBM 1430 at Foothill College out of self protection. That was a punch card system, and I learned how to program it in assembly language. That helped me a little. Then we started giving some courses internally on the 2116. We'd program in assembly language. If you could get it to spell B-O-B, it was a real breakthrough and you'd type it out.

Al Bagley recalls an interesting sidelight. In 1991, Packard asked Bags to take a look at HP Labs, to see how it was looking in various aspects? So the "Barney Oliver committee" looked at all the projects in HP Labs. He distinctly remembered Barney commenting on the computer section review, "Why don't you quit using all these crazy buzzwords and just tell us what you're doing." I think Barney was very comfortable with the 9100A calculator, but for some reason computers didn't really get into his blood.

So the 2116 was our first computer. It sold for roughly $18,000. And then we came out with the 2114, it was probably down around $14,000. It was a smaller box. I think about that time we got core stacks that had twice the memory in the same volume. A core stack was roughly 3 1/2 to 4 inches cube and I believe the 2114 was only 12 1/4 to 14 inches tall. It had fewer I/O slots, and that and the memory size were some of the major things that were different and allowed us to sell it cheaper. That was nice when you didn't need a lot of expansion capability because the system was physically smaller. The 2116 took up half of a 6-foot high rack cabinet.

The competitive DEC PDP8s did have a sort of I/O feature. They had little cards that were about three inches by five inches. But they were more for general purpose use, and it took several of them to do an interface with, for instance, a voltmeter. One of the goals of Kay's approaches to the

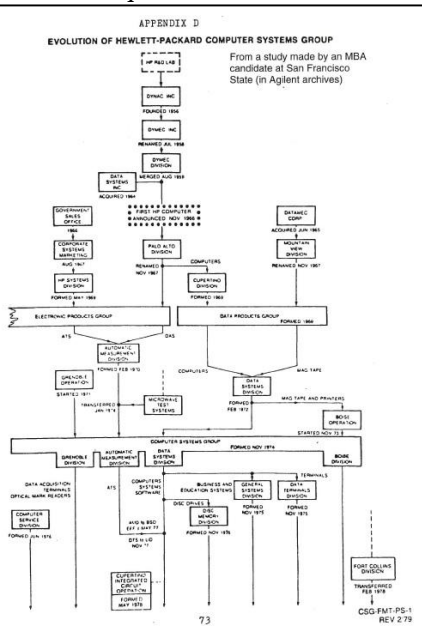
I/O was that essentially one card would program a whole instrument. If we had to customize that card, for some new instrument, we'd do it.

If we were interfacing with a teletype, that one card had a connector on it that went directly to the teletype, and all the interfacing was done in hardware on that one card. It was a nice clean job. There was a cable that went from the Teletype to one end of the I/O card and the other side went to the back plane. It worked out that we could cram everything onto one of those cards. Occasionally when we had a lot of control lines to program, like on a voltmeter, we'd have one card for programming and another one for reading the data back in. But again, it was clean. We had very few cables and we didn't have multiple cards. The PDP8 had lots of these little cards and it just wasn't a simple thing to hook up.

Associated with that one interface card, each one required a software driver, that could then talk to that one card. Conceptually it was a nice, clean system. It proved itself extremely capable for doing custom systems because it was so modular. Later on, we got away from data acquisition and into both stimulus and response systems which were really a full-blown test system. That changed a lot of things, because then we could really do testing by programming signal generators, power supplies and other stimulus, and measure their results. That whole I/O system that had worked from the very beginning, was very adaptable to leading on into that whole new approach.

With the considerable advantage to control instruments, not many were sold as standard computers. We sold them to system integrators, places like Hughes, where they were putting together systems themselves, so it was essentially the same kind of integration. I don't think many of them were used as just computational type computers.

I found an interesting 2116A Computer Evolution chart in my old documents. It traces the history of HP's computer business from a relatively modest start. The 2116A was almost strictly an instrument controller, designed for easy interfaces with programmable instruments. But it found applications as the central processor for Time Share systems, used for education and science. But its real value was that it provided the launching pad for HP's strategic moves into mid-sized computer markets, and distributed computing as the Internet started to move information far better than digitized telephone lines.



This diagram shows the evolution of the HP 2116A computer, through many years, as HP became an industry leader for distributed computing. It came from a study by an MBA candidate at San Francisco State. Click on the link below for full size.
http://www.hpmemoryproject.org/pict/timeline/bob_grimm/HP_Computer_Evolution.pdf

Dave & Bill and the Computer Business

One of our great challenges of getting HP into the computer business was trying to figure out how to sell them. That's where we decided on getting one guy from each of the four field organizations, training them, and sending them back out to the field, to be the center of the marketing push together.

I can't remember whether they spent six months or a year at Dymec? They got thoroughly indoctrinated and then went into the field. That ended up creating a very good relationship between us. But it made for a slow first year. Those computers just didn't sell like hot cakes. It took a while to even sell the ones from the early runs that we had in stock. There was a lot of internal debate,

bickering and arguing about whether or not computers ought to be in instrument systems, or if we should try to sell them for other types of applications?

Those were some very difficult times for business strategy, trying to sort out what we wanted to do as far as stand-alone mini-computers were concerned. It wasn't very difficult on the instrumentation system, because various divisions were working on their own 2116A-automated systems. I can remember working with Avondale on a system for gas chromatographs. We went around to the various divisions to see appropriate applications for them. And of course, there were some very outspoken proponents who thought that's where we really ought to go.

I think Bill and Dave were disappointed with my ability to manage the computer business. I don't know all of the ins and outs, but Dave decided to remove me from managing Dymec. I think an awful lot of his decision was related directly to how we were managing the computer business. He pulled me out and put Jack Melchor in.

I had been Dymec manager for about five years. It was one of the longer durations for an HP division manager at that time. In fact, for many years, my tenure as general manager was the longest in the computer business, because Melchor was only an interim manager. He had a reputation for being a good, hard-nosed manager, but he had not intended to stay at HP for very long. I think that before Young sent Paul Ely to run the computer operation, they went through something like eight managers. Bill Terry had a shot at it, and Carl Cottrell and Dick Anderson, and others. I felt less and less bad about it, as time went on, and some very noteworthy people had difficulty in that management role.

The History of Dymec's first 10 years is described in this 16 page brochure. Click HERE to read the story of products and customers and people.

Working for Noel Eldred

I moved up to work for Noel Eldred. It was definitely an interesting and challenging job. I certainly look back and know that I had a great time. I'm glad I participated in that original computer effort, because it was a tremendous experience, and I got to work with some terrific good people. In my next job phase, they had to park me, so they asked me go up and work with Noel Eldred, as a marketing assistant. I got some fancy title, and Noel essentially asked me to work on how we would use computers with instrumentation systems. Up until that time the other part of Dymec was still data acquisition systems, plus some RF equipment. They did not have any stimulus type equipment, so data acquisition systems was only computer-controlled system at that point.

I worked for Noel for maybe a year, and was involved in some studies. But primarily I was working on putting together measuring systems and talking to customers. We were having increasing numbers of customers who wanted us to do stimulus-based systems. I was sort of a recipient for these field requests and I was supposed to go out into the divisions and charm them into participating.

I still remember, I was at the office one night and I had this big block diagram on a giant piece of paper on my desk. My desk was in the cluster of marketing desks, close to Bill & Dave's offices. It was late at night and Packard came by. He said, "What are you doing?" I showed him this big system. It had a lot of microwave signal sources in it, and all kinds of other HP equipment. It had equipment from half a dozen different divisions. I went over the diagram with him, and explained

what the customer was trying to test, and why they needed all this equipment. It included both stimulus and measurement. It was clearly a doable system technically, and a reasonable thing for a customer to want. I said, "You know, the interesting thing is that there's no way HP can build this." I had already talked to all the divisions with instruments involved, and no one would take on the responsibility for putting the whole thing together. There wasn't enough in it for any one of them to take all the risk.

A New HP Systems Division

Out of that casual meeting with Dave, plus probably some other thoughts and observations he'd had, Packard came up with the idea of setting up another division within a month. They called it HP Systems. Dick Reynolds was just coming back from running Europe, and he was selected as General Manager. I would be in charge of marketing and R&D. They put us down in the basement of Building 11, right across from the Kodak building. So off I went into a new systems venture.

Dymec was still running, but the main thing they were doing was data acquisition systems. The Computer group was in the process of being split off or had been split off. They moved to a new HP site at Cupertino, where HP had just purchased a 50-acre site, which included 2 large buildings. It was a low point in the business cycle, and Varian was re-trenching, and HP got a grand price for that large industrial tract. So Dymec was doing data acquisition systems and the microwave type systems, but they weren't doing any stimulus type engineering. That's what differentiated between HP Systems and Dymec. We began building systems, and making both customers and field engineers VERY happy. We caught business that they had to turn down for years.

One of the best technology things that happened about that time was that computer BASIC language appeared. This ability to have a system operating in an interpretive mode, and being able to write a test program, and then run the system, was a true breakthrough. Customers LOVED to be able to install, write a test program, and then get immediate results, and that technology just changed things from night to day almost instantly. I can remember going out on sales demos with Theo Frensch, he was a great person to travel with.

All we needed to take with us for some of the demos was a 6130 power supply from the Harrison Lab Division. We'd type in a little code, and we'd just use the meters on the front of the power supply. We'd write in BASIC, inputting some desired stimulus voltage, say minus fifty volts, then to plus fifty volts. Now, start from here, and jump in ten volt steps. Then watch. Then we'd connect on a voltmeter and write a simple command to measure volts. It proved to be one of the best sales tools in the world. We were very successful, and were having one helluva lot of fun, putting those deals together. We sold a lot of them to industrial companies, bit also found interest in military operations. I personally sold the first one, to Magnavox.

Magnavox was making thick film circuits for sonar products. Our proposal was a nice system and a delightful experience. I can remember being up at a blackboard, when we were working back and forth, which to me is the most fun. They were talking about what they had to measure and all that. We'd draw in boxes, then I'd go through the HP catalog. We'd design the whole system by pulling out all these pieces of equipment and interfacing them in. The nice thing about it was that we all believed it would work, because it was basically the same equipment you'd use on a bench. I returned to HP and wrote the instructions to the engineering department. I designed all the software call statements for all the instruments, so the engineering department could write all the drivers etc. It was a very nice, clean three bay system.

I have made it sound pretty simple, but the engineering guys didn't necessarily find it so simple. The reason was that in most cases, we were starting with standard HP measurement instruments

which were MANUALLY operated. And the divisions had zero interest in designing them so they would adapt to automated functions. So our engineering had to figure how to automate the functions that we needed. This occurred well before the concept and acceptance of the HP Interface Bus (HP-IB).

As mentioned earlier, our designers were VERY creative. In a few cases they had to design knob-turners, which substituted for the human hand. They built servo driven shaft rotators, which were used to tune the usual manual crank of a klystron signal generator. They figured out how to level out the power output vs frequency of signal generators which normally required a knob tweak. This was the time that programming was stirring in the instrument divisions. Bagley's counters, of course, already had the staircase voltages for the numeric digits of the display. We could handle and translate the staircase vs number, but preferred the BCD output versions of counters, to acquire the data. Synthesized signal generators came along in the early 1970s, which made our systems jobs significantly easier.

We had standardized on the 2116A, mostly because of its generous number of interface cards, and their large size, permitting many functions to be addressed on the single card. We never did use Desktop Calculators like the 9530, from Loveland for system control. Those desktops became a HUGE deal, once the HPIB technology rolled out later, but we needed those interface cards which the 2116A had and the desktop calculators did not have. Also, the 2116A was configured for the BASIC language, which was a customer-demanded language because of the ease that their test engineering could use once we shipped their system. Actually, most customers were writing their own test programs in BASIC, after attending Paul Accampo's training course in Sunnyvale.

We didn't apply the BASIC language at first at HP Systems; but boy, as soon as we saw it, we grabbed it. I think the Microwave Division was using BASIC for their Automatic Network Analyzer. As soon as it came out, we just standardized on it. In the data acquisition systems I think we used Fortran or Assembly language. We set it up so that we pre-programmed most of the equipment functions. Then the user could then pass test variables into it. If we wanted to modify the program, we had to go back to Fortran. That was very cumbersome.

Looking back, we were involved in a period of a major change in the Hewlett Packard Company. Before that period, Hewlett Packard Company had been very careful to say, "We are in the electronic measurement business. That is our business. That defines HP, and we know we have to stay focused." Then we got into the systems business, and the computer was absolutely necessary to allow the systems to operate. Then the computer started to rear its head as a stand-alone. This happened about the time that BASIC timeshare took over technical academia. General Electric was selling programming with BASIC, on landlines with modems. But then, HP figured out how to use the 2116A as the central processor for a complete time-share system. I think it ran as many as 12 student users. So the old question, "My god, are we in the stand alone computer business or not," was being answered by customers who bought a lot of those. But leading up to that denouement, that was the biggest single argument that HP has ever had. Very frankly, it was a gut wrenching time. By the time of the HP 3000 computer, HP was well on its way to compete with IBM, and did it superbly in time.

In the HP Systems group, the stimulus and response system concept went on for a number of years and we had great success with it. Before Sunnyvale, we had been forced to move downstairs in the basement of Bldg 11 near El Camino. Ralph Lee put us there, since there were no other buildings with enough floor space as we grew rapidly. We got in with the Swedish Air Force for the ground maintenance test program for their Viggen fighter and had many other challenges as well. Then management decided to combine the Dymec data acquisition part with the HP systems part, and give it a new name of Automatic Measurement Division. After those two groups were combined,

they moved down to Arquez in Sunnyvale. We had bought the property from Fairchild. Dick Anderson was the first division manager. I went down and ran the marketing.

There was an interesting comparison between HP and Fairchild, with the work space arrangements. The entire front face of their building held private offices, maybe 10-12 of them. When our division moved in, each of those office spaces held three of our engineering and marketing people. Dick had been Al Bagley's engineering manager at Santa Clara Division and he went over to become Division Manager of AMD. Speaking of Dick, after a couple of years at AMD, Paul Ely recruited him to move to the rapidly expanding Computer Group in Cupertino. At Dick's departing ceremony, I wanted to inject a little humor, so I presented a slide which proposed a formula for the turnover of general managers in the Hewlett Packard system business. This was quite a large number, like 8 managers. I then showed the calculations to show that the MTBF, Mean Time to Failure, of systems managers, was about 18 months. The MTBF formula of course, was a critical factor in the reliability we sold with our systems.

There was another serious problem building at that time. The Automatic Measurement Division, which was then both data acquisition and stimulus and response systems, was totally dependent on the 2100 series of computers. By that time, the 2100 had come out to replace the 2116. That was also the time Cupertino had introduced the mid-range 3000 computer. They then decided they were never going to come out with another mini-computer, and that they might just discontinue the whole 2100 series computers.

It was shattering to think that might happen. Another issue that was very important, particularly for the data acquisition business, was the Real Time Executive operating system software. It did not run on BASIC, but the idea was that you could trigger software interrupts, so that once you got into something and completed the task, you could go check flags and things like that. With the Real Time Executive, you could take priority level control, and any time one came in, you'd stop what you did and jump to that. For data acquisition it was just a tremendous boon, and a feature that many customers demanded. Here we had so many things going for us in instrumentation with a real good computer system, and the computer group decides to get out of the business!

They were very serious about it. We had to go to upper management to appeal the decision, and it wasn't obvious that we were going to win.

The lower end computer business was targeted by the HP 1000 system. That family took over the remnants of the 2100 series. The 1000 is a good system. I had terrific admiration for Kay Magelby and his group for having come up with something that has had such a long life time.

Later on, Kay was an advocate for Hewlett Packard doing bigger things in the telecommunications business. He put on a couple of pitches, and finally one pitch really impressed top management to the point where they said, "I guess we ought to do that. Now what we have to do is go find somebody to manage it, someone with a big name out of the communications business." Of course, that was quite a shock to Kay. When he asked them, "Why don't you let me run that as the engineering manager?" and he was told, "Well, you're a very good engineer, Kay, but short of being a manager." His logical reply to them was, "I thought getting Hewlett Packard's first 2116A computer into production, from scratch, in one year was one serious management job." He didn't think it was just engineering. He was really disappointed that he hadn't been recognized for what he had done, a very fine engineering/management job.

That was a real gut wrenching time in Hewlett Packard's business strategy history. Al Bagley remembers that one of the heads of the company at that time said, "Politics is starting to rear its head and run this company," and it really was. Al, of course, was on personal terms with Dave and

Bill. HP certainly didn't quite have the same gut feel for strategic decisions in the computer business that we did in instruments. So guys that might wave their arms and loudly express opinions, sometimes could win an argument, without knowing what they were talking about. It really was very disturbing to see what happened.

We all think the world of Bill and Dave, but I don't think they had the right answers either, for computer strategy, nor did they pretend to. Those decisions were, by and large, up to John Young and Paul Ely. It was a very, very tough time for computer system strategies. To some extent, in the 1990s, we're still trying to figure out what kind of a computer company we are. It's also interesting that in the 1990s, there are still the remnants of an Automatic Test Division, still building a few custom systems. It's not a trivial amount of revenue, and they look about the same. Ivan Henkle was running it. I had hired him back in the Dymec days as a test technician. Now, of course, much more of this test system work is do-it-yourself by the consumers, thanks to the HPIB. Further, to a large extent, almost all instruments themselves, are now systems. They've got a lot of smarts inside them, usually microprocessor based, so the customer doesn't have to go to the computer to take A over B times C calculations. You can just do so much more.

Even with the fairly fancy desktop PC these days, there are versions with plug in slots where you can plug in a voltmeter card or a counter card and you've got a little system. There is the USB bus, which interfaces with a whole lot of instrumentation. We've moved a long way. But the turnover in management in the HP system business and computer business did a funny thing. It left people like we mentioned, still running the business down there, men who were damn good technicians and knew what they'd been doing, for the last five or ten years.

It was very striking to me once, when Dick Anderson became General Manager of AMD, he asked me for ideas as to who would make a good engineering manager. One of the people he had in mind was Kay Magelby, and what Kay told him was, "Dick, you probably think you're running that division. I'll be your engineering manager for about six months or so, just enough to show you who down within that organization is still running that place. You aren't." Kay was very perceptive. He said, "I'll take the job long enough to show you who is really running it."

By the mid-1970s, I was Marketing Manager at the Automatic Measurement Division. Dick Anderson was the Division Manager, one in a series of managers. I'd been doing this since the mid '50s. I finally decided we were starting to repeat ourselves with the same issues. Should we be in the systems business? What should be the transfer costs? Who should get credit for the sales of instruments and the computers? All those same things. It wasn't like 10 years of experience, it was more like 1-year of experience, 10 times. I decided I just wanted to do something different. I was very open about it and just decided to go looking. I didn't have any particular ideas about what I wanted to do, but I just wanted to do something different than systems. This was in spite of those years being the most fun and interesting jobs of my life to date.

My Leap to HP Labs, 1973

So I went shopping around and I talked to a number of divisions. I talked to the people at InterContinental because I thought global operations might be interesting. I talked to the people in the Handheld Calculator Division, and at one point I went up to HP Labs, and started talking. Barney had a market research position that was vacant. The objective was that if HP had an idea for some new field to enter, maybe we ought to know a little bit about that technology and market. There had been a few HP Labs projects in their past, where they just went ahead and invented it, and then tried to find a division interested in taking it to market. One such project had been called the "bandsaw recorder," which had invested near $500K, and then was dropped. The Labs was really frustrated, when they had something that was a technical success, but they couldn't find a

division to take over the manufacturing. There had been several people in this position before, including C. B. Foos. Tom Perkins, the venture capitalist, was another.

Don Hammond, Paul Stoft, Paul Green, and a couple of Lab managers, really encouraged me to go for it. Barney was also very encouraging, so I accepted. It was an interesting position, and for the first time in a long time I didn't have anybody reporting to me. I didn't even have a secretary, and all I was supposed to do was investigate the business possibilities for the Labs managers proposed new initiatives. I looked at a number of projects. One was a little pocket thermometer that Paul Stoft had coming, which would have been very simple to make. We looked at all the applications for air conditioning, Kodak, and the photography business, and others who needed to know temperature to a tenth of a degree. It would have sold for a couple of hundred bucks, but pretty obviously didn't fit the HP business model. There were a number of other such investigations.

I sat right outside Barney's office, which was interesting, because quite often he would come and go and we would never pass one word between us. I enjoyed it. I enjoyed the technical stimulation and it was quite different from what I had been doing. I'd been there maybe three months when Barney said he wanted to talk to me. He said that Paul Stoft had been lobbying to get an IC facility as part of HP Labs, because he wasn't satisfied with the small effort that was going on in Charlie Bittman's Lab area. He wanted something that could make large scale integrated circuits, because he felt that design capability was going to be essential for HP's success.

Building the HP Labs IC Facility, 1974

In fact, Paul had gone over Barney's head, to Bill and Dave, in the previous fiscal year and they had agreed that the Labs should have its own IC facility. The sequence of events at that time was that Barney was to find somebody who could set up an IC facility, and run it. And, of course, to take on the projects and processes Paul wanted worked on. Time was passing, and they hadn't found somebody they liked to accomplish this. So Barney asked, "Would you be willing to go ahead and build this facility, while we continue to look for somebody to run it?" I said, "Sure." At that time I didn't have the slightest idea of how an IC was made. I'd never been in one of those facilities. I didn't know ICs were made on wafers. Boy, was I naive!

He assured me, "We'll get you some people from HP Labs, to help you out, and all you've got to do is make it happen." I said, "Fine," and they actually gave me a very good team. I got Charlie Bittman part time and he gave me Pat Castro full time. Then, out of Paul Stoft's group, I got Chris Clair and also Jerry Alonzo and Gary Modrell. They were all electronics people. There were a couple of others who helped me on things like ion implanters and other specialty areas. Pat Castro had previous IC experience at Fairchild. She was the IC brains of our team.

The first thing we did was to look for a place to put the IC facility, an interesting process. HP Labs had no available space in any of their buildings at that time. So I went scouting around and found that Santa Clara Division was building a new building, and they had some space left over there. That was the only space we could find in an HP building. We didn't want to leave Palo Alto, but we found they had some good space upstairs in their new building. The bad thing about it was there was a sheet metal shop running in the basement, with punch presses and lots of heavy vibration.

But that was the only offer we had, so we proceeded. In fact, we did testing, where we actually shock-mounted s fifty ton punch press over in building 52. We built I-beam frames that were about a foot thick, eight inches across and maybe twelve feet long and mounted a big press up on this frame on shock mounts. Then we made measurements all over the building as to the reduction of

vibrations and we finally convinced ourselves we could get by with this method. This was in the days where IC processes used lithography techniques of contact printers.

We went ahead and designed our part of the Santa Clara building. We had a local architect, and we let a contract, and we were under construction. I went away on a trip or vacation, came back and Pat said, "We got a great deal. You're going to love it." What had happened was, Fairchild had put their Deer Creek building on the market. Better yet, they had built that as an R&D facility, for John Atalla, the Labs guru who had earlier left HP. It was Atalla's palace. We went over and looked at it and found it ideal, and moreover it was in Palo Alto. Pat had already had a meeting with Hewlett and Packard and they okayed it. This Fairchild facility became HP Bldg 25. Later, HP built a companion Bldg 26. Both had gorgeous views of the mountains and the open meadows along Deer Creek, and of the valley below.

We put a stop work on everything down in Santa Clara, took all the drawings and designs, which were mainly Pat's big push. She had a lot of strong ideas on IC construction, consequently, the HP Labs facility at Deer Creek was probably one of the best in the Bay Area at that time as far as clean room techniques were concerned.

They were still looking for somebody to run it when we were about to open. One day Barney said, "I think we've got somebody who would be good to run this place, but we want you to be involved too if you're interested? His name is John Moll." I didn't know John at all, but he was a world renowned figure, as one of the top theoreticians in integrated circuits, very highly respected. He was at Bell Labs, and then he was at Stanford. In fact, he was at Stanford at the time he decided to come to HP. He'd also been at Fairchild. Anyhow, they discussed it, and Barney decided to make me the overall administrative head, with John in charge of the technical R&D program, Pat Castro was in charge of operations, and Chris Clair was in charge of automation.

At the time that we opened, Chris Clare and Jerry Alonzo and Gary Modrell had developed the most advanced computer controlled IC processing that existed. We had something like thirty two computers, talking back and forth to each other, and that was in the mid 70s. That was quite an accomplishment, because the engineers, anywhere in the lab, could program things like the furnaces in engineering units. We could program what temperatures they wanted and what ramps--how many degrees per minute--everything in very simple form. All the parameter unit conversions that were necessary were done inside. There was automatic environmental monitoring of the whole facility, with alarms, and a lot of other neat stuff. It compared with any other IC company for that time. Each lot of wafers was automatically tracked with all processing steps recorded, with annotations by engineering and technology. This planning and execution showed great foresight, as to what was needed and what was possible.

Paul Stoft helped stimulate the early idea of putting together a good IC facility for HP labs. He mainly wanted advanced chips for his instrument projects. He didn't want his access to chips to be limited to standard industry availability. In fact, when we opened up Deer Creek buildings 25 and 26, his lab moved over to be downstairs in the same building. We worked very closely with him and we started out with two major processes. We had bi-polar and CMOS, and then we had a few other specialties like power MOS. Paul was one of our main cheerleaders, and got us into specialty things like photo diode arrays for his spectrophotometers and a lot of other projects. One of the first pressing projects, that came along at the time, was the idea that we needed to have a good source of CMOS for our handheld calculators. They needed ICs that had lower power consumption than the ones that were on the market, particularly on the drain when they were turned off.

By that time, Ralph Lee had also decided to move the handheld calculator operation to Corvallis, and they decided to build another IC facility in Corvallis. They came up with the important idea of

building their team at Deer Creek, having them develop the processes, get familiar with technology, and have that team committed to moving to Corvallis. We had about ten people there. Dave Cochran was the leader of the group and it worked out well. They developed the CMOS process, though it wasn't advanced. John insisted we be successful at what we tried, and that we not try to stretch everything. I think he was totally right, because these products were going into thousands of consumer products where reliability and HP brand image was crucial.

Next we invented the data storage chip, which was the first one to bring up the process. They also then transferred that up to Corvallis. That was a nice relationship that got established.

Director, HP Technology Research Center, 1975

We opened up the Deer Creek IC Laboratory in 1975. In 1978, they decided to go to the idea of centers, rather than individual labs. They combined all of the HP Lab semiconductor facilities under me. That included the Solid State Laboratory, with Gallium Arsenide and other processes. So, in 1978, I was promoted to Director of HP's Technology Research Center. Now, THAT was a great name, because it meant we could do anything we wanted. We also had the fiber optics work there, some project work on lasers, some liquid crystal work and some very high frequency Gallium Arsenide.

After running the semi conductor facilities for eight years, I decided I'd like to try something different. By then, John Doyle was running HP Labs, having replaced Barney when he retired. I told John that he ought to get somebody else to run my IC Labs. In fact, I'd already recommended he give it to Fred Schwettman, who reported to me. I saw Fred as a real comer and had a lot of respect for him. Fred became a vice president and ran all of the IC's and was doing a good job.

Director, HP Manufacturing Technology Center, 1984

I told John I wanted to do something else. About that time, there was a lot of discussion about manufacturing, and the competitiveness of the United States and HP in our manufacturing processes. So the question arose: Should HP do something in the area of manufacturing technologies? Traditionally, we'd never done anything in research for that area. We just sort of installed new manufacturing technologies, as they came along, or were needed for a new product. The idea of having a forward-looking manufacturing research center was bandied around with Hal Edmondson and John Young and others. I volunteered to John Doyle, that if he didn't find anyone any better to run it, I'd be glad to take a shot at it. He said, "That'd be great."

The new Manufacturing Technology Center was part of HP Labs and I still reported to John Doyle. The Lab had several projects going on that were related to manufacturing, which gave me a nucleus of about thirty people. That included Mike Lee's operation. They'd been working on robots and were successful technically, but sort of had a solution looking for a problem. They were trying to figure what to do with robotics. There was some other work going on for process development. These were questions about printed circuits and surface mount processes. There was also some software for computer aided design and machine vision. These were things going on that people didn't feel comfortable with. Should they be rolled out to product manufacturing areas for HP? Were they intended for internal use, or possibly for external sales?

So we put all that together while I was still head of the Technology Research Center, as construction was started on Building 26. I'd been the HP Labs representative on the design of that building, and what we wanted it to be, and then it was turned over to Fred. So I went off to Building 28C, and we put all of the manufacturing group together there. We stayed there about a year and then we were the first groups to move into the brand new Building 26. I figured the first

one in gets dibs on the nicest offices. We set up the labs there, for robotics, machine vision, printed circuit technology, and surface-mount technology.

There was one accomplishment I was most proud of. And yet, it was the smallest effort. It was the concept of a corporate-wide standard to design for manufacture-ability. When I had just begun the manufacturing research job, I travelled to visit the divisions, to assess the state of our production processes and facilities. Everybody knew intuitively, that unless their engineers designed right, it was very hard to make up produce-ability later in manufacturing. But how could we, in a central lab, and in a rigorous way, look at designs, analyze them and make sure they were workable? And then sell them off to an operating division to manufacture.

When I was on trips, and when I attended conferences, I kept asking about different people who were working on this problem. I finally happened to be sitting on a bus in Atlanta, Georgia, at a conference, and got talking to a man from General Electric. He said there had been some interesting work done in another part of GE, on this matter. He gave me the name of someone to contact. I tracked him down, and visited him. We got a license to use GE's training material, and ended up putting together a course, in which we presented a structured analysis for analyzing mechanical assembly designs. We gave that course to just about every product division within HP. Dave Lima and one other person gave the course. To me, it was the highest leverage project we launched. I think if I had stuck around, I would have probably put even more eggs in that basket. I would have expanded from its mechanical design focus to include circuit design and software design. We needed to provide to our divisions with the successful ways of evaluating and measuring and giving tools to engineers to do a good job in manufacture-ability.

One example of that kind of thinking was a video tape I found, which showed an IBM printer being completely assembled in a matter of a few minutes. That film became a part of the same education program. I worked very closely with Hal Edmondson, who was Vice President for Manufacturing. He had a council that met monthly, and was composed of key divisional manufacturing managers. Of course, I was on that group. Hal and I often traveled together, and we were back at Westinghouse in Pittsburgh, to look at their advanced manufacturing laboratory. They happened to mention they had just done a video about successful assembly operations. I saw that video, and it knocked my sox off. It showed the assembly of an IBM printer. The Westinghouse employee assembled that IBM printer, right in front of our eyes, put it together, plugged in the power and it ran! There was a clock running. It took just a few minutes.

There were no screws in the assembly process. I got permission to reproduce their video, and I'd say within three weeks, we had given every division a copy of it. It really communicated our message. The beauty was that once shown to division design groups, it really stimulated the idea.

Looking Back at HP, 1986

Retirement was a pretty simple decision for me. I'd already decided that I was going to retire before I was sixty, or at least when I was sixty. In 1986, when HP came up with the offer of giving me a year's pay if I retired a year early, I'd already decided. So it didn't take a lot of thinking. I guess the other thing that made it simple for me is that I had lots of outside activities going, so I was not at all worried that I would be bored with retirement. I did continue consulting and running the Manufacturing Research Center for about two or three months while they chose somebody to take my place.

I retired Oct 31, 1986. In thinking about which of my long list of jobs I liked the most, it's a tough call. I guess the thing I enjoyed the most was setting up new organizations and new entities. I enjoyed the excitement of having a clean slate, and creating something from the ground up. I

enjoyed being down at Dymec, getting it started and sorted out. In a real sense, the entire sweep of HP's dominance in the computer business, got started at Dymec, with the 2116A. That is something I'm really proud of.

The Automatic Measurement Division and the HP Systems Division I worked in, were different versions of the same Dymec systems approach, but I thought they were all good achievements. I thought my time in HP Labs, setting up the IC facility, was an exciting venture, because it was all new technology to me. And I was intrigued by the fact that there could be an organized approach to looking at manufacturing methods and getting them right.

If you looked at some of our manufacturing practices in a lot of our divisions, and I include myself, because I was a manufacturing manager down at Dymec, they weren't very sophisticated or highly analytical processes. They just evolved from the early practices of the lab making a prototype, and then manufacturing engineering tried to make copies of it without screwing it up. The idea that manufacturing could actually contribute to the process technology really wasn't appreciated as much as it is today. I think the starting up of these new entities was the most rewarding to me. If you look at which ones have survived and been significant, the computer is certainly the most dominant. But I won't take any credit personally for that. It has succeeded in spite of the number of different division managers involved with it.

The HP systems business was always complex, and it needed good management. It's interesting that the same version of the HP 2116A, that Kay Magelby invented, lasted so long. That gives real credit to his ability. Different divisions handled those customer needs differently. Some years ago the network analyzers and the spectrum analyzers of the Santa Rosa Divisions had divided up in an orthogonal sense, and now there is an instruments division and a systems division, each one expert in both network and spectrum analysis. So they're going back to the concept that we needed a systems business for customers. It is just that we kept doing it differently.

The HP evolution of the word *system*, itself is interesting. We've used the word system to define the combination of a number of separate boxes, that are put together to get some new capability. Then, as time went on, we integrated more and more functionality into a single product, and it is no longer a system, but a new box. This happened mostly as microprocessors invaded individual measuring instruments. But then we combined those to make even bigger, more complex systems.

In the beginning, we even had separate boxes to measure AC and DC voltage, and things seemed very complicated at that time. A frequency counter was another box. So we would have racks and racks of these boxes to put a system together. But that was a time when controllers were extremely primitive. They were pin boards with diodes and shorting pins. We didn't do things like calculating, or if we did, we did it in a very hard way. Now we can do so much computing with a simple little computer that we can almost hold in our hand.

I have dedicated my life to HP, and one reason is that it just feels good to work for a winner. HP's reputation in the world is like no other. I think in general it is external to the company. In spite of HP travails in the 21st century, HP is still highly regarded as a well managed company, a financially conservative company. In general it's a safe buy for HP products. You're not likely to get a lot of criticism if you're a customer, and this was particularly important to aerospace and military customers. I thought it was very interesting that when the government of France was deciding on which of two computer companies to line up with, the two were IBM and Hewlett Packard. So it's a pretty good league we were playing in. It's also a big company. In the 1990s, as I was retiring, I was talking to some friends who participated in getting a hundred million dollar order for HP. They were feeling pretty good about that sale. They said they also had to point out that HP had to get ten of those every month, or the equivalent.

As Ed Porter, who was manufacturing manager in the 1960s, once said, when some salesman was bragging about a "big" order, "That'll keep my factory going for about five minutes." We're in the big leagues now, but I and most people are proud to say that we worked for Hewlett Packard. Other people say, "That's great," and they give you credit for the good judgment of having worked there. I think we bask in the reflected glory of "our" company.

What made it great? Without any question it was Bill and Dave. Everybody has always given them credit, and I think it's their tremendous ability to look into the future. I guess even being with them there at the time, I'm still just amazed at their ability to perceive where things were going. They didn't always guess right; but I think their fundamental philosophy, which must have been thoroughly strained at times, of fiscal conservatism stood them well. If you can't pay for it, don't buy it. Their idea of profit: Don't sell low to gain market share, and wait for profit, get it all the time, right from the start.

Their concept of management by objective was key to enlist the creativity of EVERYONE. Their ways of letting everybody know what they were trying to accomplish, and letting all employees participate, was a great motivational tool. Another attribute was their willingness to let managers under them make giant mistakes, and not really come down on them, even when they were totally aware of it. I must admit that, boy, did I make some lulus? I think they expected me to recognize my mistakes, and I was usually quite aware of them, but they never raked me over the coals about doing things wrong.

In the systems business we were continually estimating and bidding on some really shaky projects, some that we knew were speculative. We made money on some of them and we lost money on some of them. But, month in and month out, Dave and Bill were extremely tolerant about letting people learn from their own mistakes. I guess just being part of their operation was a tremendous experience. Their philosophy rubbed off on a lot of the people around them who might not have been as capable in other environments as they were in HP's.

I remember a number of people I was associated with, early on, with Wholey, later with Demere and Bagley, solid guys who formed the core of HP mid-management. I think one of the HP attributes that I'm so proud of, is the fact that customers always got a helluva good deal from HP. I can remember in some cases that Packard would just say we ought to give a customer their money back, especially with complex systems. It was that simple. I remember the arguments, when the handheld calculator came out, as to what the quality level should be, for a product that "only" cost $395? Should that calculator quality be compared to instruments, where we led the market? I mean, how could we possibly put the same quality into calculators that we put into instruments? The handheld was a lot cheaper and all that. It was very interesting to participate and hear the pragmatic HP answer: If it's going to have our name on it, it's got to be good.

Doing the right things for customers was one of those fine corporate objectives, but technical contribution was another one. We were always told, "We want to be sure that our products contribute to the state of the art of technology. Move ahead. Be a leader." It was very stimulating. Our HP work culture was like no other industrial operation of the time. A number of other HP memoirs on this archive tell of those informal times, beer busts on a Friday, annual summer picnics, the annual management conference at Monterey, with the funny manager-roast posters.

One example that just came to mind. One day I got a phone call from a lady in Los Angeles. She told me she had gotten a number of phone calls for Dymec. She finally determined it was because her phone number was the same as the Dymec number, except for the area code. So if local LA

people dialed our number without the area code, they would dial her home. She joked that she could do a much better job of representing us if she knew what our product was.

So we put together a packet of our sales literature and mailed it to her with an invitation to come visit us if she was ever in the Bay Area. A few months later she notified us she was coming. We gave her a tour of the facility, took her to lunch, and made her an honorary employee. We published her picture and the story in our Dymec News. She was a great sport and we all had a good time.

John Minck mentioned a similar incident from his Microwave Division days. A woman in Palo Alto called HP, and was transferred randomly to John. It seems that HP had printed a FAX number in some publication or advertisement—which turned out to be her personal phone number. So this poor lady's phone would ring at all hours of the night, as people were trying to send a FAX to HP. With time differences on the East coast, calls came often and early morning. Of course, they kept trying because the FAX wouldn't work. She wasn't even aware of what those strange FAX tones were. That relieved her a little, but didn't prevent her from being bothered. John got the bad published number withdrawn, and then offered to pay for her to change phone numbers, with premium service. And arranged for some kind of nice gift to try to apologize for the mistake.

In Al Bagley's interview, we talked about people's work style at HP. We all know there are talkers and doers. I think engineers in general are in the doer class, it's in their DNA. If I look at every one of these projects I was associated with, there were key people around for whom I ran interference. Look at Kay Magelby. For the 2116A Computer, he had everything he needed, and all you had to do was stay out of his way, and let him get things done. And on the IC project at HP Labs, Pat Castro had the clear vision to make things happen. With the San Jose Garage project, Jan Berman really knew what she was doing, and just did it, with no need for direction. If you associate with people who know what they're doing, you can accomplish great things.

Al remembered once being at an outside conference. He was rooming with a guy who was the manager of the machine shops at Varian. Things in his shop had come to a complete halt. He asked, "What's the matter? Why aren't you shipping?" and he said, "Well, they're putting up the new buildings, and the facility crew that normally repairs our machines in the machine shop is all busy. They're working on the new building, so we have a lot of broken down machines." I knew that would never happen at HP. The guy running that HP shop would be in there at night with his pliers.

We once had a situation at Dymec. At that time all our multiple buildings were scattered all over South Palo Alto. At one time I think we had six different locations. We had shipping in one place, wiring in another and the stockroom in another. The sheet metal and machine shops were right across Park Street, but we only had part of the building. The other part of it was used by a company that made packaging material, fuzzy material that was very flammable, and they had a fire. Unfortunately, the sprinkler system for the whole building came on and we lost our sheet metal and machine shops overnight. The equipment and work in process was all doused with water.

Our Dymec affiliation with HP made all the difference in the world. We got in there with crews and we saved every piece of equipment. We found a place in South San Francisco that took everything apart and rebuilt it. We got all the equipment up there, went through all the work in process, that was on the floor, and sorted it all out as to what could be salvaged. We got people working on redoing the building facility. Within one or two days, we had all of our crew working swing shift up on the hill, in one of the sheet metal and machine shops. They were there using the equipment at night that wasn't being used. We kept that up until we got our place back into

operation. It was a real can do effort. That was Gordon Smith and Jack Tennyson. Gordon was in charge of the machine shop, and Jack was in charge of the sheet metal shop. They were just real can do people.

Bagley remembered another can-do anecdote that characterized the HP spirit. Bill Terry, Bagley and myself found ourselves on a big wide bodied jet, flying back from the East Coast. The stewardess came on and announced, "Too bad, folks, we won't be able to show the movie. Something has broken down in the projector and we'll have no movie on the airplane." Bagley looked over at me and said, "Let's go fix it." So we got permission to pry the thing down out of the ceiling and look at it. We found out what was wrong, fixed it, shoved it back up there and then the stewardess announced, "Thanks to the Hewlett Packard Company, we're going to have a movie."

Part 3--My Community Volunteer Years

For this life story, I decided that I would describe all of my civic volunteer jobs in this separate section, rather than sprinkle the stories chronologically throughout my HP years. Although my volunteer jobs started out early in my HP career, clustering the stories together, this way, shows some continuity in them. Often, my success in one volunteer agency would lead directly to the next one.

Bill & Dave were both very serious about participating in the community. Dave had been on the Palo Alto School Board, and the Board of Trustees at Stanford. Bill was on the Stanford Medical School Board, and President of the IRE. That helped me personally, because I was very interested in volunteer activities, and I ended up spending a lot of time outside of HP working on the United Way organization. I also worked on the Los Altos City Council as well as other volunteering.

United Way, circa 1960

I first got started, around 1960, when Jack Beckett got me involved in the Palo Alto Chapter of United Way. I was first asked to join the Allocations Committee. At that time each city had its own allocations. So I worked on that process for a time, and then they later asked me to join their board. I became President of the Palo Alto United Way Board and then got active at the county level.

We were in a transition at that time. The United Way of Santa Clara County was really the umbrella legal organization, and we had individual chapters. After I got involved in working at the county level, I was elected to be the President of the Board for the county. Our previous measure of success was that we always looked at how much we raised, compared to the previous year. As it was always a little bit higher each year, we felt very good. But, one of the things I'm most proud of, is that I decided to ask a more important question, and that was: how much SHOULD we be raising? And that led me to a much more significant analysis of our operations.

I scouted around and finally got data through United Way of America, which was the central group on the top of a couple hundred United Ways in the country. I started looking at the data, and normalized it, based on population, and ended up looking at the effects of buying income. I started making my report, which I called my Top Sixty report, because we were down about 60th, at that time in what we raised. I was able to show rather pointedly that we were doing a lousy job, compared to what our potential was in Santa Clara County. After all, we were in the HEART of high tech country.

I started giving talks, and had a whole presentation on the potential giving in Santa Clara County. After I became president for the county, I worked with the other people on the board and decided we ought to have what I called a physical exam. We would get some outside people to come in,

and look at how we were doing. I was convinced that the potential was there, and we could do far better, but our problem was how we were going about it.

I found there was an organization that was affiliated with the United Way of America, that did such analyses. I talked to other United Ways around the United States who had had studies done by them. This group had pretty good references, so we ended up making a list of all the things we had questions about for inquiry. At the same time, we said we'd like to have a complete physical exam. It was in reality an operations audit. Not only were we telling them where it hurt, but that we wanted a complete check up.

They did an excellent job. We involved all our local agencies that we supported, and also got a lot of community input. They did a very thorough job and gave us periodic reports, to make sure they were on the right track. They finally gave us a full report, and by the time we got that back it was about the end of my second term as president. I was then asked to headup the implementation of the recommendations, which was a bit intimidating. One of the things they recommended with fund raising was that having individual campaigns in each one of our towns, like Palo Alto, Los Altos and Santa Clara, was not going to achieve as much as we could do if we did it on a broader basis. Instead, we should consider having a county-wide campaign, and for best marketing impact, enlist some top local celebrity or executive, to gain name recognition, and to head the drive.

This became a big issue as to how we should engage the local chapters in the central drive. We put in motion the steps to start a county campaign, which is the way it is now. We did away with the individual community campaigns, but we needed a person to head that first campaign. I went over the whole pitch with Bill Hewlett and he agreed to take on the leader role. I was pretty sure I could get him to say yes. A lot of it was the same analysis of what the potential was, and the rationale of what we'd studied, and Bill was very supportive of that whole thing. That is still the United Way format. They always get one of the top people in various companies to head the drive. It is more than just a figurehead. They bring their considerable executive style to their volunteering.

They now typically have the main leader, plus another person who is going to follow for the next year, so that they have experience on the tasks. Most of the money is raised through individual donations at the donor's workplaces, so the corporate group is one of the largest donors. Another key decision is the person to head that.

One of our best successes of my period with United Way, was the low administrative percentage. Since the organization was dominantly volunteer, our total permanent staff wages were low. Our continuing objective was to be sure that the largest percentage as possible got to the people who needed it. It was a very high percentage, with a very low percentage of overhead, under ten percent in Santa Clara County.

For several years I was also President of United Way of California. The United Way of California sounds important, but it's not a very big thing. It's just an organization of all the United Ways in California that periodically get together to discuss common situations and goals.

Altogether, I spent over 20 years with United Way.

California Innovation Group

At one point, I was involved with the California Innovation Group. I was asked to join their board. I can't remember now even why I got on that. I think it was at the time I was on the Los Altos City Council. It was a group that wanted city governments to be able to take advantage of industrial organizational practices that were going on in private industry. That would include practices like

inventory control, information systems, personnel policies, and all kinds of things that are almost taken for granted within our better Silicon Valley companies. They wanted to get those going within the cities, and then there might be a two way exchange, if there were some benefits. In some cases, there were innovations in fire fighting or something like that. It was interesting.

Palo Alto Red Cross, 1970's

After my United Way period, I then got involved with the Red Cross. I was just on their board for a few years.

Palo Alto YMCA

Lew Platt was very active with the Palo Alto YMCA. He asked me to join the Board. I served for a number of years, and was on the construction committee for the YMCA facility at El Camino Hospital.

The Los Altos Library

Marion was the real active one that was involved in the community. She was a very outgoing individual, and so she belonged to the AAUW, League of Women Voters, Los Altos Library and the History Museum. She was also involved with the Red Cross, and Volunteer Bureau. She had quite a network of dedicated volunteer friends. That was in Palo Alto at the same time she lived there. She was on the Red Cross Board before I was. A lot of our social life centered around people at HP that we knew. But then, through Marion, we got to know a bunch of people locally in many civic activities. So, it was sort of a combination. We had kids growing up, and we had Boy Scouts and Girl Scouts, and our kids were in both of those, and so that got you involved in the community.

In 1996, Marion was involved in a campaign to raise money for technology and technical books for the LA Library. It was to raise $300,000, or so, and she got me to join in. I think I was treasurer of the project. As it went, I've been treasurer of a lot of things around town, for example, treasurer for the LA Library parcel tax political campaign in 2010. I think, the library is very important, and we have an excellent one here. This is definitely a library town.

Los Altos History Museum

Marion and I both were involved with the History Museum. Mary Smith died, and she and her husband, Gilbert, had a life estate on their house on their orchard, right at the downtown intersection of San Antonio Rd and Edith Ave. The City bought their orchard for the present LA Civic Center. The City Council, mainly pushed by Audrey Fisher, wanted to retain the house as a memory of the time when there were mostly orchards around here. The Council agreed, and that's about when they started up a non-profit to run it, which became the History House Association. Marion was one of the early members of that board.

First they outfitted it as a 1930's farm house, which it had been, and put up exhibits and other types of displays. But, later on, they focused more about the history of this community, than just the farm house, and that's when they needed some more space. The idea of putting up a building that looked like a barn, near a farm house seemed to do that. They approached the City Council and the City staff, and said, "We're not asking for any more land. We'd put it right behind the History House, and we'll raise all the money and then we'll give it to the City." That was a win/win for the City. So, they started a fund and put money that they raised from various events, like an antique fair, and other events, and the fund grew slowly.

About 1990, they finally decided that it was time to get serious. Since I had a number of real estate projects and construction projects I had been involved in, Marion asked if I'd get involved in this thing, and we worked together. I got Goody Steinberg, who is a good friend, to be the architect for the project. We had a bunch of committees with a lot of friends. We had a committee on almost every room in the place. There was a Kitchen Committee, and there was archives and collections, and a Historic Committee, and more. We chose a contractor, and I served as the coordinator between the contractor and all the various committees. That way each was heard, but we could speak with one voice to the contractor. It turned out real well. Goody had strongly recommended that we not get a commercial builder, instead that we get somebody who's used to building fine homes. We got Paul Conrado from Saratoga, who was the contractor that just did a great job, and he became a great friend. It's held up well. It still is a beautiful building.

The other thing that was a concern of mine, was that when it was just the History House, it was mainly run by a group of old ladies. When they needed some physical help, they'd get their husbands involved. I was very concerned that this should not be a "personal" museum, but that needed to be the community museum. By widening the leadership, they've done a much better job than I could have hoped for in doing that. The concept of regular changing of exhibits is one example of that. We change them about three or four times a year. Each time we have a different group of people creating the exhibit and installing it and working on it.

At the time of this interview, for example, we had an art exhibit that Jane Reed curated and managed. It was very attractive and came out for a few months. Then another exhibit on bicycles went in. Then we worked on the history of Silicon Valley, as seen from Los Altos standpoint, that Nan Geschke chaired. It's been rewarding, and I and Lou Brossard and Dave Backs were the builders of a lot of the exhibits. Anytime the curators wanted something built, we do that. We have the "Miracle Construction Company," and our tagline on our business cards is, *"If it works, it's a miracle."*

The nice thing about the Museum is that it is ongoing and it involves interest from all over the community. That way, it's not isolated to just things from one small group's interested, and thus, really engaging. More than a few years, Marion worked on a project to cover the WWII Japanese Internment. Marion knew a number of local Japanese friends that had gone through that traumatic event in their lives. So they really got participation by that community. A lot of them had saved mementos from those bad days, and offered them for the story. Then there were a number of events for the Japanese community to come in and present their memories. It was just a great historical extension to a whole different community of people, who had endured some real disrespect.

An earlier exhibit, that Nan Geschke chaired, was on our local author, Wally Stegner. They got the literary community involved, from Stanford, and a number of other places. So, it's been a very rewarding, and it's still a very vibrant place. One of the advantages for the project management is that they get people who have such commitment, and such abilities, to plan and coordinate the details. Every presentation that the Museum puts on is really expert, very, very, well done.

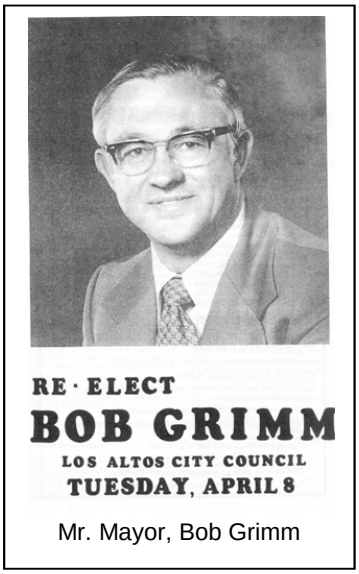
Here are a few more recent popular exhibitions: 1) Lucile & Dave Packard, 2) The Duvenecks & Hidden Villa, 3) Silicon Valley: The Lure & the Legends.

Los Altos City Council, Mayor, 1976-1984

In 1976, I was elected to the Los Altos City Council. That was a very simple situation, that was triggered (again) by Marion. She had been involved in helping some city friends, who were concerned in getting a different outlook of people on the Los Altos City Council. There was a clique in power at the time. They had been successful in the previous election, a couple of years before, in getting a couple of "good" people in. Marion's group had sponsored them. They were feeling good, and they decided they were going to find a new candidate to run in the next upcoming election. Their procedure was to interview prospects, pick one of them, and then they would support the election campaign. The problem was they weren't very happy with any of the people they were interviewing.

One day, Marion said, "We need more people to talk to." I said, "You wouldn't be interested in me," because I was not at all interested in running. She finally said, "We need somebody. Would you at least come and talk to us?" I said, "Yes, but you're not going to like what you're going to hear." So I went in, and told them all the things I believed in. I told them the last thing I wanted, was to be somebody they thought they could control. So I went through the whole interview, telling them that condition. As far as I was concerned, I flunked the interview, but I had a good time. They came back to me later on, and said they wanted to support me. They told me this a couple of days before we were going to Hawaii for Christmas vacation. So I quickly filed the election papers and got the signatures on them. We went on vacation and came back to find this big machine that was going to help me run.

Well, it turned out the campaign machine was nonexistent. There wasn't anybody who was going to get in and do a whole lot. I shopped around, and there were some people who were willing to help. Clyde Coombs, who was a good HP friend, agreed to be my chairman. He'd never had anything to do with politics. I got a number of other friends like Clyde, and we put it all together, got some neat people working on it, and I did my homework. I think there were three seats up for election and I came in third. But I got in and I beat out two or three others. But once I got in, I enjoyed it.



Mr. Mayor, Bob Grimm

It was a bit time consuming, considering I had a full time job at HP. I spent quite a bit of time on it. In addition to the meetings, I would get a weekly packet, that was delivered by the police to my home for my weekend homework. That information went over a lot of issues. I was pretty dutiful. If there was a planning issue, and someone was asking for a variance on their house, or they wanted to build a higher fence or move it, I would try, 100 percent of the time, to go out and visit them. I'd let them make their pitch or help coach them on how to come in and present their case.

Normally such matters go to the Planning Commision, and they approve what they want. Then it comes to the main Council, where it's almost a slam dunk. But what happens is that quite often the Council doesn't like what the Planning Commission approves. The reason is that, in general, the Planning Commission is supposed to make good planning recommendations and not necessarily good political ones. Quite often applicants are not happy with what they got out of the Planning Department or the Planning Commission. It's an interesting process because all kinds of people would become unhappy with what we were doing at some points. You know, you can't win all of them ever. That didn't bother me too much, and I think I brought a balanced approach to that job. Overall I very much enjoyed the whole political process. After four years I ran again, and that time I came in first.

Next, I moved up to Mayor. Each city has the option of deciding how they select their mayor. In Los Altos, the City Council selects one of its members to be mayor. While I was on the council, we decided to make the position of mayor rotational, so I analyzed a bunch of decision algorithms and we came up with one which is still being used. Whoever has been on the council the longest, without being mayor will be the next mayor. Fairly simple. You have to be the vice mayor once. If you've just been newly elected, you have to wait one year.

During my one-year term as mayor, I thought it was a fun job. You chair the Council meetings, and you go out and cut ribbons, and kiss babies and attend civic happenings.

While I was on the city council, I became a member of the Bay Area Air Quality Control District Board. There is one member on the Bay Area Air Quality Board from Santa Clara County, and I was that representative for a year. They control the processes which look over the pollution in the bay. That one was air pollution. As Mayor, I also attended meetings of the Santa Clara County Intergovernmental Council Board. That's also related to being on the city council. It's a meeting of all the mayors or a representative from each city council who meet regularly to discuss intercity problems, which don't have strictly legal connections.

One of my biggest pleasures in jobs like the Council and Mayor was the chance to meet a variety of local movers and shakers. Very successful people, who themselves are volunteering. It was interesting, and I met a lot of corporate people, and leaders from other cities and counties and even the state.

The Los Altos Festival of Lights, started in 1978

One of my all time pet projects was the Festival of Lights parade. In downtown Los Altos, the business people decorated the street trees with little white lights starting a number of years ago. It's a tradition for most cities, that every holiday season, the trees downtown have little sparkly white lights on them. After that, there were three downtown business people who came up with the idea that there ought to be some event to help kickoff the holiday season. They wanted to get more people downtown and involved.

The leaders of this endeavor were Marion Jackston, who had a very fine Children's Clothing Store, and Hope Higby, who had the Cranberry Scoop, and Jack Huston, who is part of Russell Huston Men's Clothing Store. About 1978, they came up with the idea of some sort of light parade, a poor man's version of the Disney Light Parade. They got together a few people and costumes, and started off, went around a couple of blocks, and ended up at Mac's Tearoom. I got involved because Jack Huston called me, since he knew I was an electrical engineer. He told me that they were creating a light parade for Los Altos, and they needed some technical help. Would you help us out? And in 2014, I am still working on it.

This was one of the lead floats some years ago. We got to the point where you could no longer build them in some person's back yard.

Marion Jackston knew a lady up in Redwood City, that could make these big characters for floats. They were chicken wire and then covered with plastic sheeting. So, we have Jack-in-the-Box, the

Snowman and The Little Drummer Boy, and more. These floats had lights on them, and when we first started off, we borrowed batteries from the Union 76 filling station down on San Antonio Road. He would charge up all the batteries he had in stock and loan those to us, and then we'd put them on the float. Then we needed inverters to step up 12 volts to 120 volts AC so we could use regular holiday light strings on it. The challenge was that the battery would last about as long as the parade. I remember that they just barely would make it.

We went on like that for a number of years, and then I happened to be on a week-end visit up on the Delta on a houseboat. We stopped at a Marine Supply place, and I noticed that they had a very compact motor-generator on display. I was looking at it, and reading the specs on it, and the guy came over and said, "Would you like to see it run?" And I said, "Sure." So, he pulled the start cord. It was maybe about a foot across, about eight or nine inches deep and about a foot high, and he showed us how quiet it was. It would put out 300 watts of electricity. I bought it on the spot. I brought it back to the next Board Meeting of the Festival and fired it up. I had some lights to plug into it, and they all were impressed, and said, "That's it. We've got to use it." Enough of those batteries.

It opened up all kinds of flexibility. These things were around $500 bucks at that time. We didn't have any money at all, and so Walt Singer, who ran the stationery store, came up with the idea. "Why don't we have people make individual donations of $500 to the Festival parade. We'll buy a generator, and then the donors can store it for us all year around. And they keep it for their own emergency use or their purposes and we do that.

We got about ten generators that way. Part of my job before the parade was to go around and collect all the generators. Then we'd use them, and then after the parade, we'd return them. That opened up a whole lot of capability, so then we could add sound. Ted Johnston and I worked on mobile sound, along with some other people. We built the speaker cabinets and put them on. Then Ted and I went up to San Francisco, where they were having an audio auction. They had a whole bunch of used amplifiers, some of them broken, some of them working. We bought a whole station wagon full, brought them back, and then repaired them. Then we adapted some little cassette players for the float music. So, it gave us float sounds for the parade.

As time has gone on, things have gotten fancier and fancier. We now have some -- like the first float in the parade, the leaf float, which has the snow queen up in front blowing bubbles up around her. This is all built on a car chassis, so it's self-contained. Then at the back of the float is a carousel going around with horses going up and down. Of course, with lots of music, and marquee lights all the way around, it's pretty nice. That one is so big, it now has two 3000 watt generators and a 2000 watt one.

We've gone well beyond designing these things in our own backyards. Now we're professional. Along those years, we found another win/win situation. Jim Flynn was on our Board for a while. He was the State Farm agent in town, and he was aware that up in Santa Rosa, they had an annual Rose Parade during the summer. For many years, State Farm had their regional headquarters up there, and had a float entry that was built on a car frame chassis with a car in it. It had hydraulics and a whole frame, and each year they changed the theme a little bit. But the fundamental structure was always the same. Their employees did all the work, but after a number of years, they got tired of it. It had been just sitting around. He asked if we'd like to have it if they would release it. And we said, "Sure." And so, they gave it to us.

We wanted to make something out of this nice gift, so I asked Joe Regey, who teaches set design at Foothill College, if he could help us out on the design of a new float. Joe is very talented in actual theatre productions, beyond his teaching, and he does consulting. He does theatrical scenes for

cruise ships, and also for stage shows and such. So, he's very capable, and he thought that he could do a project, and enlist some of his students to participate. Building such floats would be good experience for them. He came up with this train engine design, and so we still have that as one of our floats that's a BIG model, with a "wind-up key" up on the top of it.

When we came up with this other float idea, he said that he just didn't have the time anymore, and that we ought to contact the San Jose Repertory Theater. That's the same shop that builds all the sets for San Jose Rep. I did that. They did the carousel, and then they built another couple of floats for us. One of my favorite ones is towed by a tractor, but it has a Ferris wheel in it. It's about 13 feet high, and rotates. Then it has a train that goes around the periphery. So, that was out of San Jose Rep. The person in charge of the same shop was Erik Sunderman, who is just very talented. He particularly likes displays with mechanical stuff. So, they did a couple of floats for us. Then the following year, they said they were too busy that they couldn't fit us in, so they referred us to Opera San Jose. We had them build a couple of floats for us over there, too. We have enlisted a lot of talent from many places.

Then we wanted to have another float. We're taking some of the older floats that were built using the Mayfield Mall characters. This was the last of three that we had made from the Mayfield Mall. It was the Small World float, and we stripped that one down and then made a new float. We had tried with San Jose Rep to come up with a design, and we just were not fortunate. Then Erik Sunderman, who was over at Stanford, in the Drama Department, worked on sets with students over there building sets. He volunteered to help us. He also took on being project manager, and we paid him for this, to design this other one. The theme on it was a bunch of penguins, ice skating on a float and going around on a track. We worked with Erik on that, to get the penguins individually designed. We had a company over in Santa Clara build the actual penguins for us. So, that's another fun project.

This parade has come a long way from these little push carts that we started with. They were easy to push down State Street, but they were hard to push back up Main Street. Dave Luedtke came up with a new design, and we're now going to switch over all floats to this new base frame. It has a number of features, versus the older ones. It's made of aluminum, and is slightly lower in weight, but it has big wheels on it which will make it easier to push. It raises up the actual float theme, so it's a standard base that has a 2000 watt generator built in, with its sound system. One of the problems that we've had was that the generator is near the rear of the float. That's where the pushers are, and they're getting the exhaust. So, we built into this, an exhaust system that takes the exhaust from the generator, pipes it out where it won't get to the pushers.

Then, Dave Luedke and Deborah Baker started a program with Boy Scouts. To become an Eagle Scout, you have to have a community project. They set it up so the Scouts can come in and take one of our old floats and convert it over to a new one. The Scouts then manage the whole thing, gets other helpers to come in. We reimburse them for their materials, but they provide all the labor on that. They, usually, get their parents involved in it, too. So, it's a win/win for the Scouts and, also, for us. The nice thing is that everything that we do starts out as a small concept. Then, it jumps up to the next level. But all the time, we're bringing new people in, so it's always a win/win for everybody who's involved. In the meantime, you're just having so much fun.

So, you see, I have never had to really grow up.

School Bonds, Foothill and DeAnza Colleges

I've worked with the elementary schools and the high school here. Also, Foothill and De Anza Colleges for a number of years. I ended up being treasurer for political campaigns. One project

was for our high school, where we had a vote for a capital bond campaign. Another time was for the elementary school, both capital campaign and also parcel tax campaigns. At Foothill and De Anza College, I was on the Foundation Board. For a number of years I was treasurer. They had a financial problem then, but the Board had not been informed by the Finance Department. They ended up making commitments, thinking that they had a lot more money than they actually had. It was a mini-scandal, and they terminated the finance person.

That still left the shortage of funding. They had an audit to quantify the shortfall. One of the recommendations was to set up a separate Audit and Finance Committee, to include members from the community. Mary Mason was on the Board at that time, and she recommended that they invite me to be on the Finance and Audit Committee. So, I did that for about 15 years. Time flies. Then, we went through two bond campaigns. The last one was like $470 million. It was a big one. They're just now just finishing up spending that money. I was very involved in them.

Downtown College Prep

In the 1990's, two high school teachers at San Jose Unified School District, Jennifer Andaluz and Greg Lippman, decided to start their own Charter School, and it was to be the first Charter School in Santa Clara County. They'd heard about the Tech Challenge and wanted to incorporate that as part of their curriculum. So, they contacted the Tech Museum and said that they'd like to talk to somebody. I met with them, and talked about the Tech Challenge, and they invited me to join the Board. Ann Danner suggested that they ought to have me as the President of the Board. So, for the first seven years of the Charter, I was president of their Board.

This is a school that targets at-risk kids, mostly Latino. They are under-achieving students who enter at the ninth grade, but often, at about a fifth grade level in reading and math. They'll be the first in their family to go to college, and most of them are lower income. The good news is that we have now graduated quite a few of the kids, who have also finished college. The target is to have them be prepared and succeed in a four year college. They now have a second school out in East San Jose, which is a very tough area, that is a middle school. San Jose Unified has asked them to open another one.

The leadership is very good, and the first few years of the school, and the majority of the time while I was there, we were in rented space, not any space furnished by this school district. We were in two churches and a YWCA that we paid rent for. We fund raised money to pay the rent. Then we found an ex-fitness center that could put everybody in one location. We borrowed money to outfit that. Finally, San Jose Unified closed some elementary schools, and we got one and converted it from elementary to a high school. That one still is operating. They've done a marvelous job. You go into that school, that we converted from elementary into a high school, and it looks like it was just opened, brand new. There's no graffiti, no destruction, or anything. The students are very respectful, and as much as academics are important, it's the culture which is equally important there. It's about giving these young people self-confidence, requiring mutual respect of each other, and cooperating and all the traits that you associate with maturity.

By far, it is those dedicated teachers who make it happen. It's a lot easier to teach the students that come from college-educated households, where they learn to read long before they start to school. When they have involved parents and their role models. They then associate all that from the time that they're growing up. But it is so different for kids that don't have those role models, and their parents may be working two jobs, and they simply don't have that self-expectation. In large part, the parents really want to have their kids have a better life than what they've had. We have been gratified to see our network of skills and friends to be able to bring all those pieces together for

some remarkable and successful results. When you know that so many of those kids have gone on to finish 4-year colleges, it just feels so good.

It takes a lot of dedicated people to make that happen, year after year.

The San Jose Tech Center (The Tech), 1986

In 1986, I was talking with Bill Hewlett one day, and he said, "San Jose is starting up a new science museum, and it's something that you might possibly be interested in." I had not heard about it, but after a while I got a phone call from Peter Giles. Peter was the newly-selected president of the organization. Evidently Bill had mentioned my name to him.

I talked with him, and a new science museum sounded like an interesting project. At that time, they were talking about structuring it to be similar to the science center up in Toronto. This was about the time I was retiring from HP. I happened to be going back to Detroit for HP to visit General Motors, and I decided that while I was back there I'd just go over and see what this Ontario Science Center in Toronto was all about. I got the people to set me up for a visit back there and I went in and spent a day with them. I came back and gave a report about what I liked and what I didn't like about it, and in a short time they invited me to join the Board of Directors. At the beginning, they called it the Technology Center of Silicon Valley. The person who called me to invite me on the Board was Tony Ridder, Publisher of the San Jose Mercury News, whom I had gotten to know through the United Way. It's kind of a small world.

I joined and they asked me if I would head of the Finance Committee, which I did. I handled the financial affairs and just continued doing that for about a year or so. At that time, Anne Bowers (wife of Bob Noyce), was on the Board of Directors, and decided to quit. She had been Chairman of the Exhibits and Program Committee. I spoke with Peter Giles, and volunteered to chair the Exhibits and Program Committee. He agreed. For any museum, the exhibits and programs job is crucial, because that's what it is all about. I was handling the finance responsibilities, but I started to get more involved in the planning.

This was before we had any exhibits at all. The genesis of the Tech Museum was the Junior League of Palo Alto. One of them had grown up, back in the Midwest, and was familiar with the Museum of Science and Industry in Chicago, and others. They got to talking about here we are, in important Silicon Valley, why don't we have a Science Museum? They set up fund raising, and they raised around $50K. Then they hired a professional company to do a feasibility study. It came out positive. Then a Board was formed, I think Lucile Packard was involved in some of the early discussions. Mountain View, Santa Clara and San Jose all were

"The Tech" Museum of Innovation, in downtown San Jose, is a hi-tech destination for young people with educational displays and classes. Photo courtesy of Google Earth.

interested in having the new science museum in their city

At that time, Tom McEnery was the Mayor of San Jose, and they had a push to renovate and revitalize downtown. It had been going downhill, caused by all the shopping malls in their suburbs. They had sucked away all the department stores and other business from downtown. So, they established a Redevelopment Agency that had a lot of money. To start, they had envisioned the Children's Discovery Museum, a new Convention Center, the Fairmont Hotel, with light rail as a centerpoint. The idea of Science Museum would be another positive element in their plan. So, they said, "If you come to San Jose, we'll furnish the land, we'll build a building and we'll give you an annual operating subsidy." That's why the Tech Museum is in San Jose.

When we made a presentation to the City, it was very similar to what Fred Terman said about building at Stanford, with the term "steeples of excellence." When he was starting to become influential at Stanford, he said, "You can't try to do everything. What you ought to do is try to identify a few things and do them extremely well." Those were the things he considered the "steeples of excellence." You will become known for being the best in those areas, and you get the best people, wherever they are, to come and participate.

My pitch to the City of San Jose and the head of the Redevelopment Agency and the mayor, was that the last thing they wanted us to do was to create a tourist attraction. What you should prefer is that San Jose State University should become the best university, and they happen to be located in San Jose. If you have a hotel down there, the Fairmont, you want that to be the best hotel. You don't want it to be a Disneyland. You want us to be the best science center, and you want everyone involved to be best. Then we go out collectively and we accomplish what you want. Don't try to make everybody into something they're not. I hoped they would get that message, and they did.

But they were not so stupid that they agreed to build the building, and then hope that things would happen. Instead, they told our Board that we had to raise $15 to $20 million first, for exhibits and organization, before they would break ground. It was a lot to raise without any proven credibility. They had tried raising funds for a couple of years before I joined the Board, and weren't getting anywhere. No big bucks were forthcoming. So, we decided at a Board meeting, that we should start small, like a garage operation. In fact, we called the initial museum, "The Garage," and had a sign out in front.

We made a pitch to the City to get some space, and ended up with McCabe Hall, which was not being used at that time. It had been a theater, built during the Depression as a WPA project. It had about six or seven thousand square feet of space. We grabbed that and proceeded to create exhibits for it. I was asked to manage that project. There were four of us who did most of the work: Jan Berman, who was in charge of exhibits, Skip Wall, who was an architect in charge of facilities and modification, and Aura Oslapas, who had a design firm in San Francisco, designed the exhibits. Not one of us had any experience with a museum before.

That was a lot of fun. Peter Giles would go out and try to raise money, and he did. We ended up spending in the ballpark of five or six million there. And The Garage ended up being very successful, mainly thanks to Jan Berman, who was a former teacher. She had been on educational television, and, also been with an educational book publishing company. She was fearless in asking anybody for anything. We made lots of cold calls, getting equipment, getting money, and getting participation of high level people. It was very rewarding and set the stage. It was supposed to last for five years, and then we'd have credibility to go on to the full museum. We operated it for eight years. The last year, we had over a hundred thousand people visiting in that small space. It was a good omen for future expansion. We built some good exhibits there.

Soon it was time for bigger things. We had laid the groundwork for credibility to raising enough new money. We worked with the Redevelopment Agency, and they were going to pay for the building. Four of us made a tour of science museums in the U. S. and Canada. We probably visited 15, to look at what they had done, and what we wanted to emulate, plus to find other things we wanted to avoid. We wrote up all of these findings, and came up with pretty much, an outline of our grand plan.

We had three sets of architects. The design architect was Legorreta Associates from Mexico City. They had designed the Children's Discovery Museum nearby, which was very striking in appearance, but had a lot of construction problems. It leaked and had other deficiencies, because it just wasn't designed and built very well. This time, we wanted to have a local architectural firm do all the construction drawings, and so they chose the Steinberg Group. Then the Redevelopment Agency had its own architects, because they were doing a lot of current projects and so they needed to have in-house knowledge and capability, as well as coordinating with our plans.

So, we took architects from all three of the groups and visited about seven or eight museums in the U. S. and Canada. This was a good idea since they could talk directly to the people, the managers and the CEO's of each of these places. They came back better prepared, and I am convinced that's a good model to solve a lot of later issues. We had done the same thing for the Los Altos History Museum.

By this time, I was spending more time on the exhibits, because things weren't moving very fast. Jan Berman had been in charge of programs at that time, and I thought she had done a good job. She had a number of creative programs going at high schools in Palo Alto and San Jose. She also ran the Tech Talk series going on at Flint Center, as well as a high school technology program going in connection with Science Fair. She was really making technology things happen. We asked her if she would like to take a shot at our exhibits and she took charge and made a huge contribution to The Tech.

I can say without reservation, I worked a helluva lot harder putting that whole project together, working with the rest of them, than I ever did at HP. I guess it was just because there just wasn't anybody else. We decided on a mode of working with companies, both for the expertise that they had, on the various topics, but also deciding what equipment or artifacts we needed. Then the company would often help financially. We didn't have enough people on our team. On the paid staff there were only about four of us and then we had some outside consultants, so it was not a very big team of people involved in this project. Even in 2014, I still went in to my Tech office once or twice a week. It seems hard to get that out of my blood.

The Secret of Volunteer Organizing

Between Marion and myself, I would hate to try to estimate how many thousands of hours we have contributed to our communities over our lifetimes. But it doesn't really matter, because as you can see from the above narrative, we just saw the needs and felt that we could and should contribute our talents. I was honored to receive the Outstanding Philanthropist Award for 2011. I've been recognized by local groups multiple times for my service. In 1993, I received Purdue's Outstanding Electrical Engineer Award. Marion and I were recognized as Los Altans of the Year.

But in spite of all we did for those different organizations, we couldn't do much individually. It was the other talent that we've been able to bring along to the same vision. It is the network of friends and business associates, with a variety of skills and interests, that we've always been able to enlist in the endeavor. People tell me that the word is, "If Bob's involved, then I won't say no." That's pretty edifying. We do have a good time together. And that's what makes it so much fun.

Everything we have done has been pretty successful. Although there have been a few clunkers you don't hear about, I'd say our batting average is pretty high. There's a lot of talent out there that I could always call on. And when I called on somebody within their expertise, they're delighted to help. I can remember a time when I needed somebody to help with chemical analysis on a dirt problem that we had down at the Tech Museum. I called Joe Reagan, who at that time was head of R&D for Lockheed Missiles Space Division. I told him what I needed, and he gave me the name of a guy who was eager to help, as soon as I mentioned Joe's name. So, it's just using your network to get you some people that are very smart and very eager to share.

The key is to use your network in the best way. It's not an exploitation, it is much more an engagement of their talents. I think people enjoy that, and they get satisfaction from helping on a vision and seeing its success. Many of the groups over the years met at my house. I provide the food and wine and beer, which may have improved creativity, but we have a good time, and they look forward to doing this. We've been doing it for many, many years here. And when the weather gets warmer, we do go out around the pool. We just have a good time doing this, and the people enjoy each other.

Some Real Estate Ventures

Starting around 1969, I'd been talking to Dave Kline about real estate. Dave worked for me in the AMD Division, and he'd come up with a formula by which he could buy rental houses and come out a sure winner every time. He shared this formula with me and it was very simple. At that time, you could buy a lot of single-family houses for $15,000 to $20,000. The formula was that you didn't put down any more than $2000 maximum into a house. You made sure that the amount of rent covered all your mortgage payments, plus one percent per month rent return on your money. So if you put in $2000, you got $20 spendable cash every month. So I used the formula with a couple of friends who were realtors. I worked with them and got a good camaraderie and a good understanding. We ended up defining a couple of other parameters I wanted, and they would just buy houses for me. They'd call up and say, "Well, you bought a house today," and that was the way it was.

Naturally, that kind of deal is not without limits, and it was a bit dangerous, because it was highly leveraged. Within three or four years, I had twenty houses or so. But you know that isn't a big deal. Twenty houses cost you $40,000 those days, and you were getting positive cash flow out of it so what could you lose? With the continued growth of Silicon Valley, it really wasn't all that risky. I just wish now I would have bought more.

Dave was always the idea guy. He was always very generous in sharing his ideas. He suggested, "Why don't we build some units?" We decided to build some four-plexes. We bought land for four four-plexes. He built two and I built two, using a common builder. We also had an arrangement with a leasing agency, city and county government, to handle all the rentals and that worked very well. Then we decided to build a bigger one, so we asked the housing authority where they'd like them. They indicated a preferred area for growth, so we went to Morgan Hill, bought an acre or so of land and built one down there. That went so well, that after a couple of years, we built a bigger one in San Jose. So it just kept going.

We built to rent and we still own them. More recently I've gotten involved with other friends in Los Altos in doing subdivisions. There we buy raw land, built single family homes on them and sell them. And so far all of that activity is residential, not professional buildings. I wish that I had gotten into some commercial real estate because that would have been very interesting.

Commercial has had ups and downs, the one thing about residential is that there's always a need for it so it's pretty stable, especially in this region.

Wrapping up my Life

Marion and I had a long, fulfilling life together. She was a wonderful wife and mother, and we celebrated our 50th wedding anniversary on July 9, 2003. Sadly, she died 5 years later, in 2008.

Marion and I have found great satisfaction in all of our volunteer activities over decades. One of our favorites is this History House Museum, in Los Altos..

She was born Marion Ruth Graham, in Columbus, Ohio, and was a graduate of Ohio State University. She did graduate work in Psychology at Stanford. She was a college instructor at Bowling Green State, Ohio, and after moving to California, taught high school in San Mateo. A mother of 5, she was still extremely active in community affairs. She was involved with the Board of the Palo Alto Red Cross, a member of the A.A.U.W and the League of Women Voters. She was on the Board of the Los Altos History House Museum, and Chairwoman. Also the Heritage Council of Santa Clara County, and the Mid-Peninsula History Consortium, plus on the Board of the California History Center Foundation at De Anza College. Over time, she received many service awards and citations for community service.

I miss her.

Acknowledgements

This HP memoir is adapted from an Oral History interview between Alan Bagley and myself, at Los Altos Hills, Nov. 13, 1991. I had retired in 1986. So some of the comments in the text might be referring to the 1991 period. Additionally, about one third of the content comes from a Jan. 15, 2014 interview, done by Ginger Summit, for the Los Altos History Museum.

As Marc Mislanghe and John Minck were expanding Marc's Internet HP Memory Project, with many excellent HP memoirs from retired authors, I offered both of my oral histories for another viewpoint of the unique HP work experience. John volunteered to compile and edit and re-sequence all of that material to bring my story to this stage of publishing. I sincerely appreciate his diligent efforts to make them readable, and Marc's wonderful ability to find appropriate pictures from his large document archive.

--Bob Grimm
Los Altos, CA
March, 2015

Robert Grimm
Dec 16, 1926 --- Mar. 21, 2015

Editor's Note—

Bob, 88, died in Tanzania, Africa, Saturday, March 21, from injuries sustained when a sudden gust of wind overturned his tent Friday. He was on a trip to the Serengeti plain with longtime friends Art Carmichael, also a former Los Altos mayor, and Julie Rose, president of the Los Altos Chamber of Commerce. Carmichael said a “mini-tornado” hit their camp and a wooden bed landed on top of Bob. Carmichael accompanied Bob as he was airlifted to a hospital in Arusha, the nearest city. Carmichael said the injuries were not considered life threatening at the time, but Bob died the next day of cardiac arrest. The local Los Altos newspaper covered Bob's tragic accident at this URL.

http://www.losaltosonline.com/news/sections/news/150-news-flash/49776-bob-grimm-remembered-as-heart-of-los-altos

Bob's Memorial Service, Parkside Auditorium, San Jose, CA
May 2, 2015

A large crowd of Bob's friends, community leaders and volunteers and HP associates gathered in a large venue to honor Bob's long and fruitful life. The entire periphery was dotted with easels and photos of his varied pursuits and events. Included were interesting displays of accomplishments, like one of his parade floats from the Los Altos Christmas Festival of Lights. Another surprise was a railroad maintenance car with railroad wheels, which Bob had as a long-term loan from Fred Vertel, and, with friends would take to remote railroad lines and ride off on an adventure—of course, after getting permission from the rail line. It was pointed out later that these trips were organized by a Rail Maintenance Car Club, and the excursion might include 20 such cars. The Club arranged rail clearance and took care of liability, etc.

The best feature of the service were the heartfelt remembrances of Bob's work and passions, his devotion to the City of Los Altos and its people, especially the younger cohort. His dedication and philanthropy showed brightly in these short talks by people who knew him best.

A copy of the Memorial brochure is at http://hpmemoryproject.org/an/pdf/bob_grimm_memorial_service_brochure.pdf

Transcripts of personal remembrances at Bob’s memorial service are at
http://hpmemoryproject.org/an/pdf/bob_grimm_memorial_service_150516.pdf

Copies of memorial signs and posters of Bob’s memorial service are at
http://hpmemoryproject.org/an/pdf/bob_grimm_memorial_signs_posters.pdf

HP Memories

This memory of Bob Grimm's career at hp results from the work of the www.hpmemoryproject.org website of Marc Mislanghe, who with John Minck (and Bob's family) edited and published this Memoir. After Marc's untimely death, Ken Kuhn has now assumed the custodianship with John, and together they will continue to expand the Memoirs section.

One of the main objectives in starting this website five years ago was (and still is today) to get in touch with people who have worked at hp from the birth of the company up to today. We are interested in hearing your memories no matter what division or country you worked in, or whether you were in engineering, marketing, finance, administration, or worked in a factory. This is because all of you have contributed to the story of this unique and successful enterprise.

Your memories are treasure for this website. While product and technology are our main concern, other writings related to the company life are highly welcome, as far as they stay inside the hp Way guidelines.

***Anybody Else?** Please get in touch by emailing the webmaster on the Contact US link at http://www.hpmemoryproject.org*